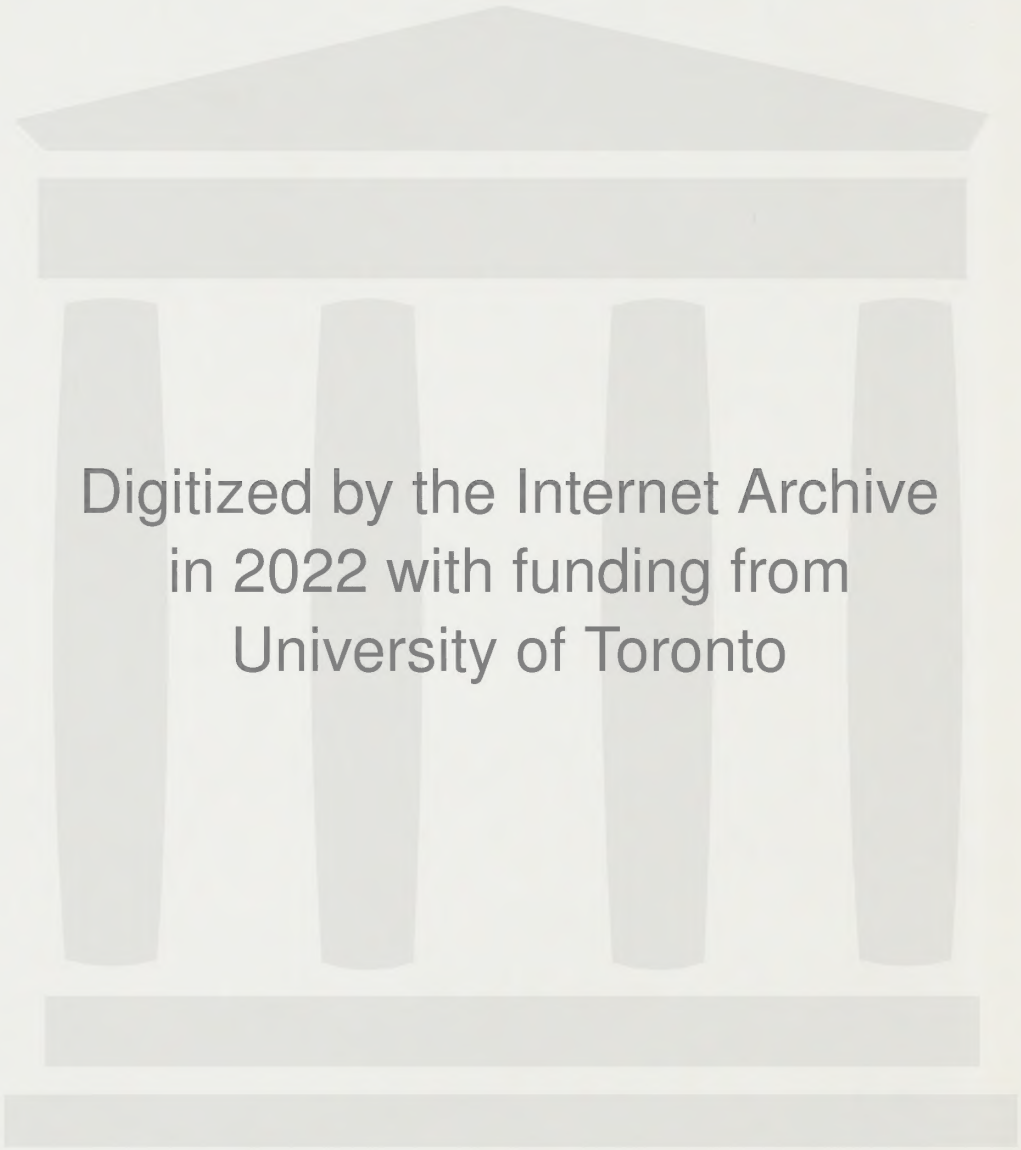

CANADA

HANDBOOK

FOR THE

INVESTIGATION OF ALLEGATIONS

OF THE

USE OF CHEMICAL OR BIOLOGICAL WEAPONS

NOVEMBER 1985

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Acknowledgments

Many people have provided advice or assistance to the Canadian Government as it has attempted to assess from afar the various allegations of the use of chemical weapons, with a view to supporting our insistence that the rule of international law be respected.

Not all of these people contributed to the preparation of this document, although their advice over the years has been taken into account. These include scientists and staff from the University of Saskatchewan; and officials and scientists from Canada's Department of External Affairs, Department of National Defence, Health and Welfare Canada, and Agriculture Canada.

Executive Summary

The final report of the United Nations Group of Consultant Experts, established in pursuance of United Nations General Assembly Resolution 37/98D, indirectly identified the need for the development of a handbook for the use of experts who may be called upon to investigate allegations of the use of chemical or biological weapons. This prompted a study on a cooperative basis between the University of Saskatchewan and the Department of External Affairs, the product of which is a first attempt at the development of such a handbook. The study sought to evaluate the requirements associated with an investigation incorporating an on-the-spot analytical capability, and these requirements are reflected herein.

This Handbook does not deal with the procedures and criteria leading to the initiation of an investigation, but rather it provides various checklists and views on procedures for the consideration of an investigating team as it prepares to implement a decision to conduct an investigation. No particular scenario has been specified of circumstances leading to or governing the investigation, as these could be many and varied. Instead, the text implicitly addresses what would likely be the most difficult situation, that of an investigation in a remote area. It bears mentioning that a prompt response on the part of the international authority will be crucial to any attempt to confirm or to refute an allegation of the use of chemical or biological weapons.

Resources mentioned (personnel, equipment and supplies) are characteristic of what would amount to a scientific expedition carried out under stressful and possibly dangerous conditions.

The Handbook assumes that the investigating team, in the course of one investigation, should be equipped to inspect two sites where

attacks with chemical or biological weapons are alleged to have taken place. It also assumes that there will be a requirement to establish a base camp in a safe and "clean" area within a reasonable distance of the site(s) to be inspected. Of particular importance is the considered view that the investigating team should possess its own analytical capability. In addition, the investigating team should be equipped to prepare up to three sets of samples for onward transmission to designated laboratories for corroborative or further analysis. In this regard, certain of the functions of the investigating team as outlined in this Handbook differ somewhat from those outlined in the final report of the United Nations Group of Consultant Experts (see A/39/488 dated 2 October 1984).

Another aspect of this analytical capability relates to the interviewing activity, preferably using an epidemiological approach to the collection and interpretation of data. It would be appropriate to conduct a certain number of interviews of victims or observers of the alleged attack(s) with chemical or biological weapons prior to conducting the on-site sampling, as certain response patterns might result which could provide some guidance to the sample collection staff. Furthermore, it should be mentioned that sampling, base camp laboratory analysis and interviewing using an epidemiological approach are not independent exercises. Each should be structured and conducted in such a way as to help provide direction to subsequent activity in the others through a feedback system.

Certain specialized equipment and supplies should probably be stockpiled by an appropriate international authority (as the Group of

Consultant Experts mentioned in its final report cited above). To avoid administrative delays, the investigating team should arrive equipped with the essentials to conduct its scientific investigation and should possess a minimum degree of self-sufficiency for operations in the field. Since it is difficult to imagine such an investigation taking place without a degree of cooperation from the country in which the investigation is occurring, it should be possible to obtain less-specialized equipment and supplies through the local authorities.

The training of experts in specific protective, sampling and analytical techniques is an area of concern that has yet to be addressed in an organized way.

Particular attention will have to be paid to the preparation, packaging, documentation and transportation of samples. A set of samples should be retained and appropriately stored by the investigating team, and later by the international authority, corresponding to the samples shipped to the designated laboratories.

The designated laboratories would report their findings to the investigating team through a contact at the headquarters of the international authority. The investigating team would later convey its final report to the international authority. Records of observations (e.g., log books, questionnaire response sheets, photographic documentation and tape-recordings) and details of analytical results and of procedures followed would all be delivered as supporting material to the international authority. The international authority should provide for the secure storage of samples for a period of time, after which the international authority, and only the international authority, would authorize disposal of the samples and of any superfluous material.

1.0 Introduction

The 1925 Geneva Protocol - prohibiting the use in war of asphyxiating, poisonous or other gases, and of bacteriological methods of warfare - remains the key to international agreements striving to ensure that such weapons of mass destruction never again be used. However, there have been instances since 1925 when chemical weapons are known to have been used; and others when chemical weapons are alleged to have been used, although circumstances did not permit confirmation or refutation of the allegations. The situation is that the 1925 Geneva Protocol made no provision for the verification of allegations of the use of chemical and bacteriological (biological) weapons. Current negotiations in the Conference on Disarmament (CD) for a convention which would abolish chemical weapons altogether have recognized the need for a verification regime which, inter alia, would include provision for the verification of allegations of the use of chemical weapons. This need for adequate verification of arms control and disarmament agreements has been recognized and stated in more general terms in the 1978 United Nations Special Session on Disarmament (UNSSOD I), and it has since been reaffirmed by the United Nations.

Since 1925, the international community has been faced with the problem of repeated allegations of the use of chemical (including biotoxin) weapons, but it has not had the means to confirm or refute these allegations. We are all concerned that the authority of the 1925 Geneva Protocol, and the deterrent effect of a strong and adverse public reaction to the use of chemical weapons, not be undermined through the inability of the international community to react on the

basis of reliable information from open sources. Clearly, intelligence information coming from one or more national authorities has serious drawbacks as a basis for international action. Nevertheless, it can focus attention on an area of concern which, in turn, could contribute to arguments for an investigation by the appropriate international agency.

In 1980, the United Nations General Assembly passed Resolution 35/144C authorizing the Secretary-General to establish a Group of Experts to investigate certain allegations. The mandate of the Group was extended in 1981 by Resolution 36/96C. The most significant problem encountered by the Group in executing its mandate was that it was not permitted access to the sites where the alleged attacks with chemical weapons were said to have taken place, and the conclusions of the Group's reports (A/36/613 and A/37/259) reflect this fact. This experience contributed considerably to the movement within the General Assembly to authorize the Secretary-General not only to investigate allegations of the use of chemical weapons, but also to take certain steps in anticipation of such a requirement. This authority under Resolution 37/98D is discussed below in greater detail.

In late-1983 and early-1984, other allegations of the use of chemical weapons prompted the Secretary-General to initiate an investigation on his own authority under Article 99 of the Charter of the United Nations. It was within the same framework that the Secretary-General had the investigation continued in 1985. In both instances, the Secretary-General reported his findings to the Security Council.

Resolution 37/98D, on provisional procedures to uphold the authority of the 1925 Geneva Protocol, was mentioned earlier. Paragraph 4 of

this resolution "requests the Secretary-General to investigate, with the assistance of qualified experts, information that may be brought to his attention by any Member State concerning activities that may constitute a violation of the [1925 Geneva] Protocol or of the relevant rules of customary international law... ."

Paragraph 7 of the same resolution "further requests the Secretary-General, with the assistance of qualified consultant experts, to devise procedures for the timely and efficient investigation of information concerning activities that may constitute a violation of the Geneva Protocol or of the relevant rules of customary international law... ." It also included the request "to assemble and organize systematically documentation relating to the identification of signs and symptoms associated with the use of such agents as a means of facilitating such investigations and the medical treatment that may be required."

It is not surprising to find, then, that a considerable amount of work has already been done to elaborate procedures for the investigation of allegations of the use of chemical weapons. Some of this work was done by the Group of Consultant Experts established in pursuance of United Nations General Assembly Resolution 37/98D, whose final report was submitted to the Secretary-General of the United Nations on 24 August 1984, and subsequently distributed as Annex II of document A/39/488 on 2 October 1984. Canada was pleased to be able to contribute to the work of this Group through its submission (as conference room paper 1) of detailed observations on the 1970 Report of the World Health Organization (the latter entitled "Health Aspects of Chemical and Biological Weapons"). Officials, organizations and individuals

from several countries have devoted much time and effort to problems related to the verification of allegations of use, sometimes within the context of the multinational negotiating forum in Geneva and sometimes as an independent contribution to the body of knowledge related to such matters. Some such work - notably from Sweden, Norway and Finland - is identified in this document.

In its final report, the United Nations Group of Consultant Experts recognized its inability to develop a standard handbook for the use of investigating teams. Instead, it compiled a form of select bibliography which might constitute the nucleus of a library which could be maintained and expanded, for the use of experts and investigating teams. At the same time, the Group of Consultant Experts, in Section IV of its report, called upon Governments as well as national and international organizations to "communicate to the Secretariat new information available to them regarding either technical aspects of the procedures or the documentation" which were the subject of its report.

It was with this in mind that Canada's Department of External Affairs commissioned a study by two scientists on the staff of the University of Saskatchewan. The study, it was hoped, would constitute a step towards developing a handbook for the use of investigating teams as an "aide memoire" in dealing with various aspects of an investigation. These and other scientists involved in the study brought to bear experience from different domains, including work on environmental pollution and environmental protection issues; first-hand experience of the problems involved in collecting, packaging and transporting environmental and

bodily-fluid samples for subsequent analysis; experience with problems related to chemical defence; and experience in anthropology and in devising and administering questionnaires.

As the United Nations Group of Consultant Experts indicated in its final report, there is a "continuous accumulation of knowledge in this field" such that any handbook or set of procedures will have to be improved and updated in keeping with technological and other developments. Nevertheless, such a handbook is both useful today in the context of the existing authority of the Secretary-General under resolution 37/98D or under the Charter of the United Nations; and it should also be of use in the future in the context of a verification regime that would likely be part of a future chemical weapons convention as it is currently being negotiated in the Conference on Disarmament. In the latter instance, we might see the establishment of an international secretariat which would bring together the necessary expertise and materiel support in a standing organ of the convention. In such circumstances, we would expect the technical section of the secretariat (which will be identified subsequently as the "technical secretariat") to make significant strides in improving upon any existing procedures, at least partially as the result of any declassification by States Parties of technical documentation which would be of assistance in the verification of the convention. In the meantime, however, we move hesitantly toward effective procedures drawing on information from unclassified sources and upon whatever related experience one can find. It is in this vein that Canada is submitting the report of this study to the United Nations.

It is worth mentioning that this Handbook does not deal with the procedures and criteria leading to the initiation of an investigation. This aspect of an investigation was addressed in Section II of the final report of the United Nations Group of Consultant Experts; and this issue is still very much a subject for negotiation in the Conference on Disarmament with respect to a future chemical weapons convention. The focus of this study is on what investigators should bear in mind when called upon to implement a decision to conduct an investigation, including the procedures that should be followed and the equipment that might be needed. So as to avoid the repetition involved in outlining procedures and equipment for a variety of circumstances or scenarios, the text implicitly addresses what would likely be the most difficult situation - the investigation of alleged incidents in remote areas. In other circumstances, the procedures and equipment would be tailored accordingly.

2.0 Outline of a Verification Procedure

2.1 General Considerations

It goes without saying that a prompt on-site inspection by an international team of experts would be the most effective way to confirm or to refute an allegation of the use of chemical weapons. This does not mean that investigations involving interviews and medical examinations of refugees in neighbouring countries, or the medical examination of victims in hospitals to which they have been evacuated, are not also worthwhile. On the contrary, all such activities will contribute to the determination of what may have transpired and, it is hoped, contribute either directly or indirectly to a reduction in human suffering (even if the result of unexplained natural phenomena).

Clearly, the need for a prompt on-site investigation does not presuppose a violation. Nevertheless, the very act of making an allegation promotes an emotive response on the part of the world public and on the part of the accused. Add to this the fact that an on-site inspection would likely require some form of local cease-fire, and it is conceivable that a complainant could be making the allegation for a variety of reasons. While a refusal to cooperate in an investigation cannot in itself be taken as confirmation of the allegation, repeated instances of such behaviour could not help but undermine the accused party's credibility, since such behaviour would be consistent with what one would expect should the allegation be correct. It is expected that, in the context of a future chemical weapons convention as it is currently being negotiated in the Conference on Disarmament, there will eventually

be much more effective means than now exist to bring pressure to bear on parties to cooperate in such an investigation.

In the case of an unfounded allegation, a prompt investigation would also be of considerable importance. The reason is that any time delay makes it much more difficult to conclude with a high degree of confidence that something did not happen. At best, one might only be able to say that the investigating team (and subsequent laboratory analysis) did not find any evidence to confirm scientifically that chemical or biological weapons had been used. (There may still be circumstantial or hearsay evidence such that the allegation may not be totally refuted either.) Such distinctions may be subtle, but their implications are not, in that any delay in investigating the incident may leave lingering doubts which continue to poison the international environment. Thus, there is an obvious connection between the promptness of the investigation and the effectiveness with which the investigating team can address the problem and arrive at scientific conclusions.

The ideal situation would be one whereby the investigating team could be on-site, where the incident is alleged to have taken place, within 24 hours. Clearly, there are very real and practical problems involved in translating the ideal into reality. For example, the information related to the attack must be transmitted from the site of occurrence to the appropriate authorities in capitals, through various levels of military and civilian bureaucracy. Then, after evaluating the situation, a decision must be taken to make a complaint to the appropriate international authority, conveying whatever information

may be necessary to meet the criteria for initiating an investigation. Each of these stages takes time.

Once the information has been considered by the international authority and a decision taken to initiate an investigation, a number of activities can take place simultaneously. The international authority will have to determine whether an on-site inspection is feasible (with the agreement of the combatants and involving a local cease-fire if the site is still a combat zone). Other matters related to right of passage (for personnel, equipment and samples) and local security will also have to be arranged.

If a technical secretariat (including experts in various disciplines) with stockpiled equipment is in existence, it will be possible to place an investigating team with its supporting equipment on immediate standby. If circumstances warrant it, they could even be dispatched to a "holding point" in a country more easily accessible to the country or region in which the investigation would take place. Then, upon receipt of the necessary clearances and upon being informed of the procedures to follow, the team could make contact with the designated authorities and proceed with the investigation.

The process is rather more complicated when there is no technical secretariat in existence. As is now the case under resolution 37/98D, there will be a need to communicate with experts whose names appear on a list, and these experts ideally should be able to drop whatever they are doing and proceed either directly to the "holding point" mentioned above or to the headquarters of the international authority. Bearing in mind that there may be some risk involved in conducting an on-site

investigation, there may then be some hesitancy on the part of the experts and, consequently, there may be a requirement to contact additional back-up personnel. The need to brief the team, assemble equipment (see Section 3.0) and designate responsibilities to individual team members will all take a certain amount of time. Such an ad hoc approach will inevitably produce time lags. An optimistic assumption would be to expect that everything could be completed in a matter of days, certainly less than two weeks, provided the necessary supplies are stockpiled somewhere.

Of course, the above considerations are most relevant if there is a possibility of gaining access to the site where the use of chemical weapons is alleged to have taken place. If this is not the case, the other alternatives which may be available to the team are: access to victims and/or materiel samples in the rear area of the complainant country; similar access in a country neighbouring on the conflict; or access to victims and/or materiel samples in countries remote from the conflict. As mentioned earlier, the evidence obtained in such circumstances is also important, but the activities involved in investigations under such circumstances may not be accompanied by the same degree of urgency (and, of course, concern for the safety of the investigating team) as in the case of an on-site inspection.

2.2 Specific Considerations

Much has been said in general terms about the on-site investigation that is to take place, although the activities constituting an investigation have yet to be identified. One reaches a point of diminishing returns in trying to specify in great detail what may or may not have to be done. While it is possible to generalize to some extent, much will remain to be decided on the spur of the moment and on the initiative of the officials involved. Nevertheless, the details described in sub-section 2.3 constitute an illustrative list of the activities that would be associated with an investigation.

This paper assumes that the investigating team should be equipped to investigate two sites where attacks with chemical or biological weapons are alleged to have taken place. Each site may require two full-day visits for sample collection purposes, quite apart from the time required to interview and/or examine victims and observers (which would likely be carried out in rear areas in any event). We have assumed that the investigating team may have to operate from a base camp for up to seven days in its investigation at each site, but the base camp would be in a safe locale away from the site.

The paper also assumes that samples will be analyzed, divided, packaged, documented and stored (temporarily) in the base camp laboratory facility. To these may be added "control" samples, including blank and/or spiked samples. These samples will then be delivered under escort to the laboratories designated by the international authority to conduct the detailed analysis (the "designated laboratories").

The base camp laboratory constitutes the investigating team's own analytical capability. It will perform other functions, such as preparing samples for onward transmission to designated laboratories, but its main functions are to perform analyses, to guide the work of the team and to contribute in a major way to the evidence the team will consider in arriving at its conclusions. This paper describes a working formula different from that which appears in the report of the United Nations Group of Consultant Experts (see A/39/488 dated 2 October 1984, pp. 30-31). While both approaches could probably work, we considered it important to minimize the number of people handling the samples before they arrive at the designated laboratories. We also believe that in the other approach the investigating team would be delegating too much of its responsibility and that the team members would not be obtaining as much first-hand information as they could. In other words, the team would be too reliant on analyses being conducted (after some delay) by other (designated) laboratories. Clearly, there are advantages and disadvantages to both approaches, but we have come to the conclusion that the investigating team should possess its own analytical capability in situ.

In the same vein, it bears mentioning that, while a good deal of this paper addresses the problem of distributing samples to designated laboratories, it is the investigating team appointed by the international authority that will conduct the operation and submit its report to the international authority. The reports of the designated laboratories will be directed to the investigating team, and the results of their analyses will provide a set of data which the team will consider

in conjunction with the results of its own scientific analyses (conducted at the base camp analytical laboratory) and other information gathering activities. It would be surprising to find that some data and information did not conflict in any way with other data and information. The ultimate task of the investigating team is to weigh all of the evidence in the balance to arrive at a conclusion as to whether or not chemical or biological weapons have been used as alleged by the complainant. In one scenario, where it may be glaringly obvious to the investigating team as a result of its own on-site inspection, analyses, medical examinations and interviews that such use has taken place, it may well not be considered necessary to seek corroboration from as many as three designated laboratories. The team could decide to make its report as soon as it has the evidence, in its view, to support a firm conclusion.

2.3 Details of a Verification Procedure

It bears repeating that the "command and control" arrangements for the investigation will have to be undertaken by the international authority. In particular, certain clearances will have to be obtained, and it will be officials of the international authority who will have to arrange any cease fire. These officials will likely precede the investigating team to the country in which the investigation is to take place, and they will be required throughout the investigation to provide liaison between the team and the national authorities of the country (or countries) whose cooperation is essential to the investigation.

2.3.1 Preliminary Activities

The international authority should:

- notify and assemble the experts and supporting personnel;
- check for completeness of equipment and supplies (assuming these are stockpiled);
- dispatch the investigating team and equipment to a "holding point" in a neighbouring country (this may or may not be considered desirable);
- instruct the team to decide in advance on individual responsibilities and distribution of tasks;
- arrange for the team to practice basic drills and procedures, time permitting;
- obtain clearances for personnel, equipment, supplies and samples;
- arrange a local cease-fire, if necessary, to take effect at a specific time for a specific period, and ensure secure

communications with appropriate authorities throughout (with back-up means).

2.3.2 Regional Support Activities

The international authority should:

- dispatch the investigating team and equipment to a "contact point" in the country where the investigation is to take place;
- arrange for a briefing by authorities on details of the alleged incident(s), locale of the alleged incident(s), security and administrative matters;
- arrange for witnesses (observers) of the alleged incident(s) to be available to be interviewed by the team, as certain preliminary information will be useful to the team for site delineation and on-site sampling purposes.

The investigating team should:

- proceed to a secure base camp in a "clean" environment within one-hour radius of the first site by local (ground) transport;
- establish a base camp, which will consist of decontamination and disrobing point, sample storage areas, analytical laboratory and administrative areas on clean ground;
- establish communications with appropriate local authorities responsible for security and local cease-fire.

2.3.3 Sample Collection Activities

The sampling party of the investigating team should:

- proceed to a site of an alleged incident (personal protective clothing worn to and from base camp, in "open" state);
- adopt the "closed" state upon arrival at the site;

- identify and delineate the sample site;
- conduct on-site screening to determine the hazard (and degree of personal protection necessary to maintain);
- lay out a grid to facilitate sample collection;
- collect, temporarily package and document samples for transport to base camp;
- decontaminate sample packages and personal equipment;
- return to base camp.

2.3.4 Base Camp Activities

The sampling party of the investigating team should:

- deliver the sample packages to the expert in charge of the base camp laboratory;
- proceed through the decontamination and disrobing area of the base camp.

The expert in charge of the base camp laboratory should:

- conduct analyses at the base camp laboratory;
- divide samples for rearward transmission to designated laboratories; package, document, and store as appropriate;
- provide guidance to the sampling party for a return visit to the site (if possible), based on the results of base camp analyses.

2.3.5 Interviewing and Other Activities

These include:

- interview and/or examine victims, observers, as well as medical personnel who may have treated victims;
- take samples of bodily-fluids (or organs of deceased); package, document, and store as appropriate;

- collect "control" samples of environmental and bodily-fluid materials; package, document, and store as appropriate;
- arrange for "spiking" of certain "control" samples.

2.3.6 Transmission of Samples to Designated Laboratories

The investigating team should:

- deliver sample packages by "safe hand", i.e., accompanied by an expert or designated support personnel;
- document receipt and condition of samples.

2.3.7 Reporting

These include:

- designated laboratories to report to the investigating team leader their findings and details of analytical techniques used;
- investigating team prepares a final report to the international authority.

3.0 Resources and Training

In this section, an attempt has been made to identify the resources and training which would have to be taken into consideration should there be an attempt to mount an on-site inspection in a systematic way. Given the assumptions which were mentioned in sub-section 2.2, it becomes clear that what one is describing is something akin to a scientific expedition. In fact, that is what it is, under conditions which will likely require a degree of haste and involve a degree of danger. Clearly, the number of personnel and the quantity of equipment involved in the operation will have to be decided as a function of the circumstances which the investigating team will face. Some of these, such as the combat situation in the area to be inspected, may be known; others, such as the cause of an illness or death, will have to be considered initially as unknown (or, at least, unconfirmed), and may well defy the best analytical efforts of a "standard" (or "minimum") investigating team.

3.1 Personnel

The ideal situation, which does not prevail at the moment, would be one whereby an international technical secretariat exists on a permanent basis with a staff of appropriately trained experts and technicians immediately available to be dispatched to conduct an on-site investigation. Similarly, the necessary equipment and supplies would be immediately to hand. Furthermore, the members of such a secretariat would be aware of the personal risks involved in conducting an on-site inspection which, by virtue of the terms of their employment, they will have accepted. It is understood, of course, that the international authority would do everything in its power to minimize such risks.

For the time being, however, such an international secretariat does not exist. As mentioned in sub-section 2.1, the current situation requires that the experts and support personnel be assembled in response to a complaint. Such persons would be chosen from a list on the advice of a technical advisor to the international authority (for example, to the Secretary-General of the United Nations).

3.1.1 Composition of a Team Meeting Minimum Requirements

In various other publications, it has been mentioned that the investigating team should comprise a nucleus consisting of a military expert, a chemist, and a medical doctor (with any of a variety of relevant specializations). To these one would have to add an interpreter (possibly so that team members can communicate with each other, and probably so they can communicate with the target population). The list could easily expand depending on the circumstances or preliminary reports that will have been communicated to the international authority. Such a larger team is described in sub-section 3.1.2. A functional approach to the tasks to be performed by the experts and the support personnel of the minimum-requirement team would suggest the following:

Sample Collection Staff:

- a civilian chemist with experience in dealing with highly toxic substances and, preferably, with some knowledge of chemical and bacteriological warfare (CBW)
- a military expert (preferably also with scientific qualifications, but at least with a knowledge of CBW defence)
- a medical expert, military or civilian, with some knowledge of CBW symptomatology and effects and of epidemiological principles

- an interpreter
- a radio operator
- a driver (locally provided)

Base Camp/Analytical Staff:

- a scientist/technician familiar with analysis of highly toxic samples and with the analytical equipment provided
- a medically trained technician familiar with basic procedures of analysis of bodily fluids and handling of microbiological tests
- a radio operator/electrician/storeman
- a driver (locally provided)

Interviewing Staff:

- the interviewer (could be the medical expert or the medical assistant. Under certain circumstances, the presence of an anthropologist or sociologist versed in the local culture and folklore may be required.)
- a second interpreter (locally provided)
- a second driver (locally provided)

Thus, an international investigating team could consist of a minimum of eight people, not counting locally provided personnel, and be reasonably self-sufficient. It would include: two scientific experts, another scientist/technician trained in analytical chemistry, a medical expert, a medical technician, an interpreter, and two radio operators. To assist them, the national authorities would provide a qualified interpreter and three drivers (each with a vehicle capable of carrying five passengers and specialized stores). Accompanying them would likely be one or two military and/or civilian officials from the

country in which the investigation is taking place, and up to five people (possibly including soldiers) to perform general duties and to provide local security. A significant military presence should be discouraged, if circumstances permit. The accompanying personnel would have their own transportation and carry the supporting equipment (such as base camp supplies). In total, the group would consist of less than twenty people, including experts and local personnel, in five vehicles. Under certain circumstances, less support may be required, but it should be the prerogative of the investigating team leader (probably the military expert) to decide according to the situation. In view of the above, it bears mentioning that not all of these people actually travel to the site of the alleged incident.

It should be understood that personnel will have to perform a variety of tasks. For example, the medical expert travelling to the site may be called upon to document and to photograph the sample collection (still photographs and/or video recording), although his primary responsibility would involve dealing with any medical emergency that might arise. Similarly, the military expert would probably conduct the on-site survey to determine the hazard; identify and delineate the sample site; then assist the chemist in on-site screening, sample collection and packaging. The interpreter could perform certain general duties, such as transporting empty containers to the sample collectors and transporting the filled containers to the site perimeter where they could be watched by the radio operator. A division of labour such as indicated here is something that would have to be agreed upon prior to arrival on-site, and this preparatory phase takes on increased importance

when experts and support personnel are assembled on an ad hoc basis. This issue will be addressed further in sub-section 3.4 entitled "Training."

3.1.2 Composition of a Larger Team

In the event of preliminary reports which might indicate the use of a chemical or biological agent that does not fit into any of the known categories, a larger scale investigation may be needed. This could require a much larger effort and call upon many other medical and scientific specialties as well as some of the social sciences. For example, in addition to the "minimum" team, one might include experts with background in:

Veterinary Toxicology	Plant Pathology
Microbiology	Clinical Toxicology
Dermatology	Pathology
Neurology	Anthropology
Ethnology	Sociology
Psychology	

The above list is not exhaustive, but it does include most of the disciplines which might have to be deployed to investigate an incident of alleged CBW use involving either an unknown agent or pathogen. The major problem in such an investigation will be the lack of experience with chemical and biological warfare agents on the part of most of those experts likely to be available and who are not attached to the defence establishment of their respective countries. Hence, there would be a need to develop short training courses, in order that such experts could be fully utilized (see also section 3.4, "Training").

3.2 Equipment

The lists of equipment which follow are meant to be illustrative of what may be required for the "minimum team" as described in sub-section 3.1.1. Obviously, one could go to extremes in detailing equipment to meet every contingency under all possible climatic conditions and circumstances. Common sense will ultimately have to prevail in terms of the quantity of equipment the investigating team should take with it. One should be able to expect that most personal needs will be met and much of the support equipment will be provided by the authorities of the country in which the investigation is taking place. Any expenses associated with this would be a matter requiring prior agreement between the international authority and the authorities of the host country. Nevertheless, even with the cooperation of the local authorities, the investigating team has to take with it a basic stock of personal-protective, sampling, analytical, and support equipment and supplies.

3.2.1 Personal Protective Equipment

On the assumption that the team should be able to visit two sites, and to visit each site twice, each member of the investigating team should have the following:

- 4 complete sets of protective clothing (including butyl rubber gloves and boots)
- 4 extra pairs of butyl rubber gloves
- 2 gas masks with canisters/filters
- 2 extra canisters/filters
- appropriate clothing for prevailing climatic conditions
- a sterile field dressing, an atropine auto-injector and a personal decontamination kit

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Note: Throughout this Handbook, sections typed single-spaced give technical details which may not be of general interest.

In addition to the above unit of issue per member of the team, the team should carry 10 extra masks-plus-canister for the use of supporting personnel that will be provided by the host country (in the event they have not been issued suitable equipment). Similarly, 10 pairs of non-woven coveralls should be taken along for the use of supporting personnel (e.g., disposable garments like "Tyvac"); as well as 10 extra pairs of protective gloves. These personnel should not require the same degree of protection as the investigating team, since they should not be allowed to enter the alleged contamination area. Because of the possibility that the standard medical kits and palliatives are either insufficient with respect to efficiency or amount available, or because of the possibility that an as yet unknown agent has been used, there is a need to have the medical expert equipped with standard drugs and instruments to allow for non-specific, life-supporting treatment regimens (see section 3.3.4, "Medical Supplies"). The fact sheets in Appendix 9.1 of this paper give a number of details on properties, toxicology, cautions and first aid treatment for certain CBW agents. These fact sheets are illustrative of the type of information that should be readily available to the investigating team.

3.2.2 On-Site Screening Equipment

This should include the following:

- 4 automatic vapour alarms (2 for use on-site, 2 for use at base camp)
- 2 portable kits for detection of vapours from nerve, blister, choking and blood agents
- 2 kits to provide tests for chemical agent in water
- detector paper

The kits used to screen for agents in the air and in water would also be integral elements of the sample-collecting equipment. To this

may be added other equipment. For example, for field use, specific high efficiency, large volume air collectors capable of collecting hundreds of cubic meters in a reasonable time, as well as passive samplers with solid adsorbants, are most practical. A wide variety exists of emplaced sampling systems, countercurrent liquid (solvent) samplers, and man-portable samplers for vapour, smoke or aerosol.

3.2.3 Base Camp Analytical Equipment

3.2.3.1 Equipment Needed

This should include the following:

- Thin Layer Chromatography (TLC) equipment
- Gas Chromatography (GC) equipment [e.g., Varian Model 3700 with integrator (e.g., Varian Model 4270), capillary columns (e.g., DB-1, DB-5, DB1701, DBWAX films), and detectors (FID, FPD)]
- 1 centrifuge for blood samples
- 1 set dyes and rack, etc., for staining of blood smears
- 1 portable power generator

This equipment will have been verified prior to dispatch (under escort) to the "contact point" in the country in which the investigation is to take place. It will have been appropriately packaged and sealed.

3.2.3.2 Details of Base Camp Analytical Equipment and Technique for Chemicals*

Thin Layer Chromatography (TLC) requires a minimum of equipment to provide a powerful separating tool for the qualitative identification of chemical agents and for purifying material for quantitative analysis by other means, e.g., infra-red spectrometry or mass spectroscopy. The sample is spotted at the edge of a rigid plate which has been coated with silica gel. In contact with a solvent (mobile phase), each component of the spotted material moves differentially along the plate according to its relative attraction to the mobile or solid phases. This forms a chromatogram which is developed by exposing it to selected reagents to produce color or fluorescence. For a particular compound the distance travelled by the spot relative to that travelled by the

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* Throughout this Handbook, sections typed single-spaced give technical details which may not be of general interest.

solvent front is characteristic and is known as the retention factor (R_F). The R_F value is compared to those obtained for two reference compounds to increase reproducibility (ref #1). Recent improvements in spotting techniques, plate technology and detection methods have resulted in detection limits of 5-10 pg for therapeutic drugs (refs #2, 3).

TLC systems have been developed for known chemical warfare agents, for trichothecene mycotoxins (refs #4, 5) and for organic arsine compounds (ref #6). Commercially available plates and equipment for multiple spotting can produce highly purified samples for subsequent detailed analysis at designated laboratories and may well serve to dramatically reduce the volume of samples which must be shipped to them. Additionally, TLC may well serve to guide investigating teams in the subsequent choice of location for sampling (for example, on the second day at the site). This would be an example of the kind of feedback which should take place between one activity and another.

Gas chromatography (GC) techniques, which make use of capillary columns coated with stationary phases of different polarities and selected detectors, afford highly sensitive means for the identification of chemical agents or their breakdown products. A system for use in a mobile laboratory (including an assembly for automatic on-column injection, a chart recorder to display a chromatogram in response to detector signals and/or an electronic integrator for computing peak areas) requires approximately 1.5 m^2 of bench space and minimal floor space for gas cylinders. The equipment is relatively inexpensive and it can be readily mounted in a truck or van. Several companies have developed mobile mass spectrometers in vans, such as the Brucker MM-1 and Sciex's TAGA 6000E. These could be adapted for CW investigations.

In general, the GC approach to analyses for chemical agents involves extraction of a sample with a solvent such as dichloromethane, followed by on-column injection. A flame ionization detector responds to the components of the injected sample and its signal is produced as a chromatogram by a strip chart recorder, thus providing a permanent record of the analysis. Computation of peak areas, and hence quantitation, is accomplished by an electronic integrator. Capillary columns of at least two different polarities and temperature programming (50-300°C) are used to relate retention data to that of a homologous series of n-alkanes. A GC retention index for a compound of interest is then calculated using the following expression (ref #7):

$$RI_c = 100n \left[\frac{t_{R(c)} - t_{R(z)}}{t_{R(z+n)} - t_{R(z)}} \right] + 100z$$

where c = compound of interest

n = difference in carbon number between two n-alkanes either side of compound (c)

t_R = retention time

z = carbon number of n-alkanes immediately prior to compound (c)

Detection limits of 150, 200, 250 and 300 pg have been reported for Sarin (GB), Soman (GD), Mustard (H) and the lachrymator CS respectively. A flame photometric detector can be used to confirm the presence of phosphorus or sulphur atoms.

Pentafluorobenzyl derivitization of water samples, or water extracts of soil or vegetation, which permits analysis of the breakdown products of nerve agents by the same GC procedure, may well be applicable for field use (ref #8). Retention indices are compared with tabular data for compound identification and findings are later confirmed by GC-MS in designated laboratories.

Methods for the analysis of known chemical warfare agents, including many degradation products, have been established but not yet standardized for inter-laboratory use (refs #9, 10, 11). Selected procedures which can be used in the field would be worked up as part of the preparation for deployment of the mobile analytical laboratory. However, new methodology is continually appearing in the literature so that updating will constitute a major task for the analytical team which is assigned to the mobile laboratory.

Staining of blood smears may assist in the rapid recognition of abnormalities of the hematopoietic system, hence the necessary equipment ought to be available.

As it is advantageous, for certain analyses, to separate cellular elements from blood serum, a bench-type centrifuge should be available.

3.2.3.3 Details of Base Camp Activities with Respect to Microbiological Agents

It is unlikely that warning and identification devices will be capable of instant or very rapid identification for all possible micro-organisms and their conceivable variants.

For bacteria, many approaches aimed at increasing the speed of identification are being developed. The one-dimensional, continuous strip culture and the capillary tube methods, combined with suitable colour indicators, may give valuable information. The fluorescent antibody (FA) technique can be employed, and other methods based on immune body reactions (ELISA, radioimmune assay) give highly reliable results.

Identification of viruses and rickettsia is more difficult, since they are only able to grow and reproduce inside living cells (tissue culture), but the immunological methods are equally applicable and successful.

A novel approach for the identification of microorganisms is based upon detection of key biochemical components of microorganisms. Micro-organisms contain substances which are more or less unique. Detection of characteristic compounds will indicate the presence of microorganisms,

even if there is no indication as to whether they are alive or dead. The partichrome analyser method is based on staining with the dye ethyl violet. This dye stains microorganisms more efficiently than it does other aerosol particles, such as dust. The instrument derives its name from the scanning method where two photocells - one sensitive to blue light and the other to green - simultaneously register the light transmission of particles impacted on a sticky tape (ref #12).

It may not be possible to carry such sophisticated equipment to the base camp. The investigating team will likely collect and expedite samples to the designated laboratories. In these cases, the main concern of the team would be to ensure that samples are collected into sterile containers, with or without substrates or growth inhibitors (in the case of viruses), and to make sure that the samples are kept properly cooled/refrigerated. Rapid transport to designated laboratories is absolutely necessary.

References, Sub-Sections 3.2.3.2 and 3.2.3.3

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3.2.4 Support Equipment

The investigating team would also bring the following:

- 3 radios, one of which is a spare (range 100 km)
- 4 short-range radios (walkie-talkie)
- 1 portable power generator, and ancillary equipment
- batteries
- battery charger
- 2 cameras (still photography) and film (black and white, colour); one camera could be of the polaroid variety
- 2 video cameras (with built-in sound recording capability)
- 10 flashlights and rechargeable batteries
- 2 hand-pump sprayers for personal decontamination purposes, approximately 5 litre capacity

The authorities of the country in which the investigation is taking place will provide the investigating team with appropriate base camp facilities, including: a separate secure area for setting up the base camp analytical laboratory, a secure storage area for samples, and appropriate accommodation for the team. These should be within a one-hour radius of the site of the alleged incident by local ground transport, and they should be both "clean" (i.e., not in an area that may have been contaminated by agent) and secure. It may be necessary to occupy these facilities for three to seven days for the on-site inspection of each site. In the event free-standing facilities are not available, the following should be provided to the investigating team:

- 5 x 5-man tents (2 sleeping, 1 for stores, 1 as base camp analytical laboratory and 1 to act as temporary storage facility for samples)
- 2 camping-style portable gas stoves and ancillary equipment
- 5 shovels
- 5 pick-axes
- 8 camping-style gas lanterns

Of course, arrangements would also have to be made for supporting personnel provided by the government of the country in which the investigation is taking place.

3.2.5 Transportation

Transportation requirements were mentioned only briefly in sub-section 3.1.1. The ideal situation would be one in which the investigating team arrives with its specialized equipment and supplies installed in one or two of the team's own vehicles. This suggests a degree of preparation one step beyond that indicated in the report of the United Nations Group of Consultant Experts (see A/39/488 dated 2 October 1984, paragraph 28). This would surely be the most secure means of transporting the analytical equipment. Additional transportation could be acquired locally with the assistance of the national authorities.

3.3 Supplies

Just as it is expected that certain equipment will be provided by the authorities of the country in which the investigation is taking place, so it is reasonable to expect that certain general supplies will also be provided. Nevertheless, the investigating team will wish to bring with them certain technical supplies to avoid delays and, in some cases, to ensure that they are of a known standard or purity.

The quantities of materials mentioned reflect the assumption that the team should be equipped to visit two sites twice.

3.3.1 Decontamination Supplies

The team may wish to bring with it the following decontamination materials, although most can probably be obtained *in situ* through the authorities of the country in which the investigation is taking place:

- Fuller's earth (in bulk and in impregnated mitts)
- bleaching powder (also known as calcium hypochlorite or chloride of lime)
- sodium sulfite
- sodium sulfide
- bicarbonate of soda
- sodium hypochlorite
- ammonia
- sodium hydroxide
- formaldehyde
- sodium carbonate
- liquid detergents which include chlorine

Such materials are bulky but could be required both for decontamination of personnel and equipment and of sample containers.

3.3.2 Sampling and Packaging Supplies

Samples will be taken of air/vapour, liquids and solids; and may include samples of bodily fluids and tissue. Since it may not be known whether one is dealing with a chemical or biological agent, there will be a requirement for a certain number of sterile containers.

Air/vapour samples will be the most easily obtained and the most compact to transport. Environmental solid and liquid samples (not including snow or ice) will provide few problems as well. Clearly, the samples posing the greatest problems will be those that must be kept refrigerated or frozen. These include snow or ice samples as well as bodily fluids and tissues, if the latter are not fixed in formalin for histological examination.

Assuming two visits to each of two sites, and 20 samples taken on each visit, there will be a requirement for packaging for 80 samples. If we add to these 20 "control" samples, we then have 100 environmental samples altogether. These, in turn, will have to be divided and sent to the designated laboratories, which we have assumed to be three in number. Assuming also that one set of samples will be retained and stored by the international authority for reference purposes, the requirement has grown to at least 400 sample containers of varying sizes. These do not include requirements associated with the collection of bodily fluids and tissues.

For illustrative purposes, we have assumed that <u>each</u> of two incidents would involve the collection of up to 20 blood and 20 urine samples and 5 samples of tissue. To the total would be added 20 "control" samples of blood and 20 "control" samples of urine, resulting in 60 samples of <u>each</u> of the two bodily fluids and 10 samples of tissue. Again these would have to be divided for distribution to the three designated laboratories, with another set of samples being retained for reference purposes. Thus there will be a requirement for at least 480 containers for bodily fluids and 40 containers for tissue, as well as larger thermal

containers capable of carrying a significant quantity of the smaller containers.

All of this appears to suggest a good deal of bulk and, in the case of the glass containers, some degree of fragility. It bears mentioning, therefore, that many of the containers would indeed be very small.

The supplies could include the following:

General supplies and tools

- 2 lockable storage boxes with padlocks
- 5 small spades or garden trowels
- 5 small garden shears
- 10 multi-purpose pocket knives
- 3 tweezers, 30 cm, stainless steel
- 2 scissors
- 4 Pro-pipet bulbs
- 100 x 5 ml disposable pipets
- 100 x 10 ml disposable pipets
- 100 cotton swabs
- 10 packages of paper tissues
- 10 x 300 m rolls of fabric tape (terrain marking)

Supplies for collection of human or animal tissues/fluids

- 2 medical kits with necessary instruments to conduct autopsies
- 80 syringes to take bodily fluids samples
- 500 x 10 ml "Monoject" sterile blood collection tubes (containing anticoagulants)
- 200 x 10 ml "Monoject" sterile blood collection tubes (without additives)
- 1,000 Venoject blood collection needles
- 400 x 10 ml sterile glass test tubes with caps
- 200 plastic bags or plastic bottles for collection of tissue to be fixed in formalin
- 2 x 1,000 ml formalin (formaldehyde, undiluted)
- 1 x 100 ml sodium citrate or Versene
- 1 x 100 ml thymol
- 1 x 500 ml alcohol

Supplies for collection of specimens for microbiological examinations

- 200 x 5 ml sterile glass test tubes with caps
- 600 x 2 ml sterile glass test tubes with caps
- 200 sterile petri dishes
- 200 sterile (clinical) spatulas

- 4 thermal containers each capable of holding 150 x 2 ml glass test tubes
- 100 x 100 ml all Teflon bottles with Teflon caps (screw-on)
- 100 Mylar bags

Supplies for collection of specimens for chemical analysis

- 4 self-contained water sample modules, each containing 50 sorbent tubes
- 200 foil-covered Mylar bags without plasticizers (capable of holding 1 kg)
- 200 x 100 ml all-Teflon bottles with Teflon caps (screw-on) or the same number of glass bottles with Teflon caps (screw-on)
- 200 x 25 ml all-Teflon bottles with Teflon caps (screw-on) or the same number of glass bottles with Teflon caps (screw-on)

Supplies for packaging, labelling, shipping, etc.

- 20 x 5 litre metal containers (with lids) filled with vermiculite
- 2 x 100 metre rolls of heavy-duty aluminium foil
- 50 corrugated cardboard boxes - 45 cm x 30 cm x 30 cm (collapsed)
- 5 polystyrene coolers (45 litre capacity)
- 40 "freeze paks" (to be filled with water and then frozen as ice packs for cooling)
- 1,000 labels (10 cm x 10 cm)
- 500 temperature-sensitive strips to be affixed to packages
- 10 x 100 metre rolls of quality sticky tape
- 10 luggage straps (to secure coolers etc., in transport)
- marker pens, assorted colours (indelible, waterproof variety)
- 10 log books

3.3.3 Analytical Supplies

These include reagents, solvents, gases and other supplies to support GC and TLC analysis as discussed in sub-sections 3.2.3 and 5.1.

For GC analysis:

- Syringes 5 µl
- Agent Standards, e.g., VX, GA, GD, H 0.03 mg/l in chloroform and/or simulants
- Alkane Standards, C_1 to C_{32} 0.1 mg/l
- Gases (highest purity), air, hydrogen, helium, nitrogen
- Filters, Drierite, molecular sieve, dust and oxygen removal
- Chart paper and ink refills
- Hexane, 10 litres

For TLC analysis: The following is an illustrative list of solvents and materials for detection of some agents:

Agent	Solvent	Developer
VX	Chloroform-Methanol (4:1)	Dragendorf reagent
GD	Diethyl Ether	Schoenemann reagent
HD, Q, T, HN-1, L	Dichloromethane	UV light or potassium permanganate solution
DM	Benzene-Acetic Acid-Isopropanol (17:1:2)	(1) Bromocresol purple (2) Dithiazone (3) Iodine solution (4) Michlers Ethyl Ketone
Trichothecene Mycotoxins	Chloroform-Methanol (9:1)	4-(p-nitrobenzl) pyridine 1% in chloroform-carbon tetrachloride 2:3; tetraethylene-pentamine 10% in same solvent mixture
CR, CN	Hexane-Acetone (7:3)	UV light or potassium permanganate solution

These examples are taken from references listed in section 3.2.3.2, and do not cover all possibilities.

3.3.4 Medical Supplies

Apart from the medical equipment identified in sub-section 3.2.2 for sampling purposes, the medical expert should possess a separate kit to deal with medical emergencies involving the investigating team. This kit should include standard drugs and instruments to allow for at least non-specific, life-supporting treatment regimens. It will also include drugs to deal with known regional health problems which could affect unacclimatized personnel. The medical assistant will be provided with a first-aid kit not including sensitive drugs.

Additional items could be obtained through the authorities of the host country. The team should obtain a small number of portable oxygen bottles and masks in this way.

3.3.5 Miscellaneous Supplies

It remains to be decided whether the investigating team should bring its own rations to cover the period that it will be operating in the field, i.e., up to a maximum of two weeks (operating out of a base camp for up to one week for each of two sites). In keeping with the figures used in this document, this would mean sufficient rations for the 9 team members for two weeks. These rations could be of the dehydrated variety available in many camping stores and as standard rations in the armed forces of many countries.

In addition, the authorities of the host country should be prepared to supply the team and supporting personnel with:

- distilled water;
- cooking fuel;
- heating fuel;
- sanitary supplies; and
- fresh or preserved rations.

3.4 Training

In the event that a permanent technical secretariat will be established in the context of a future chemical weapons convention, it is to be expected that this body will initiate training programs in a variety of areas, such as: personal protection, hazard identification, sample collection (environmental and biological samples) and handling, decontamination, analysis in the field (base camp analysis), as well as first aid, to mention a few relevant to this paper.

For the time being, however, neither the personnel nor the material resources are centralized under an international authority in a way that would permit such in-depth training. Current arrangements are such that an investigating team will be assembled on an ad hoc basis from lists maintained for such purposes or on the strength of an invitation to a number of countries to provide suitably qualified experts. Given the urgency accompanying such a situation and the consequent need to minimize delay, there will likely be little time for the experts to undertake any training at the team level; although, once assembled, they will likely use to advantage whatever time they do have to try to standardize their respective procedures. Under the current circumstances it is probably less important to try to ensure that all experts work according to some common set of "standard operating procedures" (SOPs) than it is to ensure that they adequately document the procedures they have agreed upon as they implement them. While this will be important during all phases of the on-site investigation, it is particularly important with respect to the procedures followed in base camp analysis.

This being said, it may be worthwhile for the Secretary-General of the United Nations to consider the possibility of establishing short training programs or seminars and field seminars for experts whose names have been put forward in accordance with General Assembly resolution 37/98D. It might even be conceivable that a few teams could be established so that they could go through any such training and familiarization process together.

4.0 On-Site Screening and Sampling

4.1 Preparations

Until such time as the investigating team has determined the nature and geographical extent of the hazard, it should adopt personal protective measures to ensure that they are not exposed, thus jeopardizing both their health and the mission. They should adopt appropriate measures at the base camp prior to proceeding to the site (probably "open state"); adopt full protective measures prior to investigating the site of the alleged attack and until the hazard survey indicates otherwise; decontaminate sample containers, equipment and protective equipment prior to leaving the site for the base camp; and complete the decontamination and disrobing in the appropriate area of the base camp. While judgment will allow these procedures to be modified according to the circumstances, it cannot be over-emphasized that it is better to err on the side of more stringent safety precautions, even if this may attract some local attention to the group. (Local authorities would be expected to deal with the public in such circumstances.)

4.1.1 On-Site Screening

Valuable information can be obtained during the initial reconnaissance of a contaminated area through the use of nationally available kits for detection of known chemical warfare agent vapours and liquids or chemical warfare agents in water sources. While providing data for application in the analytical process, the kits will also enhance the safety of personnel who are engaged in sampling procedures by indicating whether protective masks must be worn or whether they may be removed and for how long.

A typical kit for detection of vapours from nerve, blister, choking and blood agents would contain a hand pump, nerve agent vapour detectors, sampling tubes and necessary reagents for performance of up to 20 series of tests. Detector paper, which will distinguish liquid persistent and non-persistent nerve agents (V and G) and vesicants, would also be provided together with tubes which may be used to sample unknown agent vapour for subsequent detailed analysis. Instructions for the performance of the various tests for known chemical agents and for recognition of the distinctive colours produced within detector tubes would be included in the kit. The tests are sufficiently sensitive that negative results will indicate when protective masks may be removed. Automatic alarms and chemical warfare agent monitors are also available to assist the investigating team.

Similarly, various kits are available to provide tests for some chemical warfare agents (nerve agents and mustards) as well as the cyanide ion, arsenic, strontium, copper, lead and mercury in water.

A detector kit will be used by the investigating team to assist it in choosing a clean location for performance of base camp analysis and for initial screening of a suspected area for known toxic agents. Positive results obtained with the vapour detector or water testing kits will expedite the determination of a chemical agent by focusing the choice of analytical procedures. Negative vapour detector results will not necessarily exclude the known agents and recourse will be taken to extraction of materials such as soil or vegetation and subsequent analysis for the agents themselves or their breakdown products. Positive

results from chemical agent detector kits will be of assistance, of course, when it comes to labelling sample packages for onward transmission.

4.1.2 Site Delineation and Layout

If an alleged attack site has been identified, and if the means of an attack is known or suspected (artillery bombardment, free-fall bombs, rockets, spray from aircraft), it will be easier for the team to delineate the site for systematic sampling. An early indication of the nature of the suspected agent (droplets, spray, "smoke") and of climatic conditions and prevailing winds will also guide the investigating team in laying out a grid which, in its judgment, would have a high probability of containing the suspected agent if it is still present.

Signs of an attack, such as craters or shell or bomb fragments; carcasses of dead animals; an odd appearance of vegetation; tar-like or unusually coloured spots or residues; oily slicks on water surfaces - all of these are obvious indicators of interest to the team. Laying out a grid does not preclude the collection of other samples elsewhere in the vicinity, but these should not be confused with "control" samples which should be collected in areas sufficiently remote from the site of the alleged attack so as not to have been contaminated during the incident under investigation, or any other such alleged incident.

Using the signs mentioned above and with information which may be obtained from observers, the investigating team will endeavour to locate the centre of a chemical attack delivered by artillery shell, rockets or bombs or the centre line of an aerial spray attack. With these identified, a simple grid system will be used to locate the points from which samples are to be taken in an area approximately

500 m x 500 m (1,000 m x 1,000 m in the case of aerial spray). Square graph paper, with vertical axis lettered A, B, C, etc., and horizontal axis numbered 01, 02, 03, etc., will be used to locate sampling positions relative to the estimated centre of attack. Sampling points at intervals of 100-150 m (300 m for aerial spray) will be chosen on rays from the centre at 45° separation. The direction of magnetic north will be indicated on the squared paper and the location of the estimated centre of attack will be identified by grid reference from a military map of the area if possible, or in relation to a distinguishable terrain feature (e.g., road junction, hill or bridge, etc.). At least one carbon copy of the sketch of sampling locations will be made. While not to be construed as rigid in its application, a sampling grid of this type will permit systematic and efficient sample collection. The graphical record of sampling locations will form a necessary part of the report of the investigating team as well as an excellent record to guide any subsequent visit(s) to the alleged attack area.

4.2 Sampling and Temporary Packaging

The on-site inspection team will endeavour to obtain samples from the sample site in the following order of priority:

1) munitions and/or agents

2) environmental samples (air, soil, vegetation, water)

3) biological samples (animal, human)

The reason the term "temporary packaging" is used is that these samples must be transported to the base camp's analytical laboratory where they will be divided and packaged for onward transmission to the designated laboratories. The term does not imply that any less care or any lower standards are involved; quite the contrary. Furthermore, while these containers should not be re-used to collect other samples, in each case they can be used to hold the corresponding portion of the sample for retention and storage by the international authority for reference purposes.

4.2.1 Air/Vapour

Collection of air/vapour samples should be by solid adsorbant tubes (e.g., Poropak, Tenax-GC, etc.) or filters of fiberglass reinforced Poropak®, using hand-pump or battery operated sampling systems. Air samples can also be obtained in tubes containing only silica gel which are provided with portable detector kits. For continuous sampling, a minitube air sampling system which is capable of remote radio control may be effective (ref #1). Air samples should be collected at the downwind edge of a contaminated area, if possible. The canisters of protective masks of personnel in a suspected attack area would be another source for the analysis of air-borne CW agents. The charcoal in the canisters will trap a wide range of agents including those of low molecular weight such as hydrogen cyanide, cyanogen chloride and phosgene (ref #2), while a filter which is placed above the charcoal will trap particulates. A further source of CW agents can be found in the vapour which is evolved from soil and vegetation following gentle warming of these substances and which can be analyzed from the head-space of a sealed container (ref #2).

4.2.2 Liquids and Solids

Samples characterized as liquids and solids include munitions (or remnants thereof) as well as environmental, human, animal and vegetation samples.

Munition "duds," remnants and fragments are highly desirable sources of sample. In the case of unexploded munitions, it would be most desirable if the authorities of the host country could provide an explosive ordnance expert to defuse the munition; but, if this is not possible, the military expert of the investigating team could likely supervise the controlled demolition (by personnel of the host country) of the munition in a way that would both maximize safety and ensure a high probability of capture of some of the agent (if present). Particular precautions would have to be taken with such munitions, even when defused. A sample of the content of any such munition should be collected separately and transported apart from the container holding the munition.

Environmental samples consist primarily of earth and vegetation. Soil, sand or rock in the direct vicinity of dissemination or at least downwind of the event would be an important source of CW agent. Because the analysis of soil is complicated by coextractants, samples should contain only minor amounts of organic material (humus) (ref #2). Sand and soil samples need not be taken beyond 2 cm in depth, but preferably from about 1000 cm^2 of surface area. Such samples should be collected in glass or Teflon bottles or foil covered Mylar bags (without plasticizers).

Vegetation is an excellent source of sample absorption/adsorption, especially if sampling is done soon after the suspected attack. The most useful samples will be collected from plants with large leaves in unwooded areas, particularly from plants that are withering. Additional samples could be taken from grass, bushes and grains (ref #2). Quantities will vary, but approximately one kilogram of material might be collected in each instance and put into non-plastic bags. Another source of environmental sample is the surface of permanent structures such as buildings, walls, paved surfaces and painted or oily surfaces of field vehicles. These can be sampled by scraping, swabbing or washing (with collection of the wash) and transported in bottles or tubes.

The procedures for collecting biomedical samples should proceed according to the recommendations indicated above, but with special emphasis placed on the preservation of the samples. As a rule, preservatives should not be added to urine samples as this may complicate chemical analysis; however, if a biological agent is suspected, this rule does not apply. Blood samples should be kept cold but not frozen, as the latter will cause hemolysis of the blood. An anticoagulant can be added, the most suitable being sodium citrate or Versene. Heparin, potassium oxalate and fluoride are not as desirable. Fixatives, such as formalin, have to be added to tissue samples, if a specific purpose is identified, e.g., histological examination (ref #3). Samples which are not fixed must be refrigerated or frozen as soon as possible after collection to minimize deterioration. If facilities for chilling or

freezing are not immediately available, sample containers can be wrapped in cloth saturated with water or a mixture of water and alcohol. Ice may be used. Once chilled or frozen, specimens must remain so throughout transit.

Sampling of water from ponds, streams or reservoirs is carried out in order to determine whether the water is or has been contaminated. Samples from both surface layers and deep water are taken by scoop or siphon. A minimum of 50 ml should be collected in a clean glass bottle equipped with a Teflon liner and cap. Stability of the CW agents can be increased with chloroform extraction of the water sample at the base camp or by lowering the temperature of the sample. Decomposition is minimized with transport on dry ice. In the absence of dry ice, the use of thermally insulated polystyrene boxes (e.g., so called picnic coolers) will result in adequate preservation of specimens if ice packs are added. In addition to water samples, debris (e.g., surface scum) and bottom sediment samples should be collected (ref #4). Analysis of dissolved gases in water depends, of course, upon the retention of the compounds/agents in the water. Sample containers should be filled completely, sealed airtight and refrigerated but not frozen (ref #4). Snow and ice samples pose particular problems because the agent might hydrolize if the media are permitted to melt (ref #5).

References, Sub-Section 4.2

1. Minitube Air Sampling System; Canadian Centre for Advanced Instrumentation, 30 Campus Drive, Saskatoon, Sask. S7N 0X1. The system consists of a number of field-based microprocessor-controlled samples and a specially modified gas chromatograph to perform the analysis. the power supply is either AC or batteries; the ambient temperature range is -5°C to 40°C.

2. Rautio, M. (Coordinator). Technical Evaluation of Selected Scientific Methods for the Verification of Chemical Disarmament. Helsinki, 1984.

3. Sunshine, I. (ed.). CRC Manual of Analytical Toxicology. The Chemical Rubber Co., Cleveland, Ohio, 1981.

4. Gripstad, B. (ed.). Chemical Warfare Agents. Nils-Henrik Lundquist, publisher and director-general, The Swedish National Defence Research Institute, Stockholm, 1983.

5. Royal Norwegian Ministry of Foreign Affairs. Research Report on Verification of a Chemical Weapons Convention-Sampling and Analysis of Chemical Warfare Agents Under Winter Conditions, Part III. Oslo, Norway, 1984. See also CD/518, Norway, June 1985.

4.2.3 "Control" Samples

Control samples are prepared from matrices (e.g. water, soil, plant and animal) as similar as possible to those of the samples taken from the site of the alleged attack, but remote from that site and not under any suspicion of being contaminated with an agent from the attack. Similarly, if human bodily fluids have been collected from alleged victims of chemical or biological weapons, it will be useful to obtain control samples of such fluids from other members of the population as close as possible to the socio-economic and cultural/racial status of the alleged victims. These members of the population should not have been exposed to the events which led to the allegations nor to any similar events.

Control samples, after analysis in the base camp analytical laboratory, will accompany the samples dispatched to the designated laboratories. It is extremely important that the designated laboratories be unable to distinguish control samples from the other samples. In addition, the designated laboratories should include their own control samples upon receipt of the sample packages so as to check the reliability of their own analyses. The purpose would be to reveal faulty analyses or procedures so that corrective measures could be taken. This would be considered an internal laboratory procedure, left to the initiative of the designated laboratories; but, in the event this is done, it should constitute an element of the laboratory's report to the international authority. The results of the tests of all samples should be recorded and processed in the same way.

For illustrative purposes in compiling lists and quantities of supplies as in sub-section 3.2.2, one can assume that 25% of the total number of samples might be control samples.

The issue of "spiking" certain control samples is discussed in sub-section 5.2.2. Similarly, samples known to be "blanks" could be included with the controls.

4.2.4 Temporary Packaging

As mentioned earlier in the paper, the term "temporary packaging" should not suggest less rigorous standards in the quality of the containers used or of the security measures taken. However, sealing of the containers may not be required, as the containers should remain under the observation and physical control of a team member from the time the sample is taken until it is delivered to the base camp analytical laboratory. Double bagging of samples may or may not be required, with excess void space removed from the internal and external bag. Breakable containers should be placed in more rigid containers, with protective material (vermiculite, styrofoam, excelsior or charcoal impregnated wadding) to protect them from puncture or breakage.

Tags or adhesive labels should be affixed to each sample container, and on each should appear a code which will refer to a team member and to the appropriate log book where all the information relating to the sample will be found. If on-site screening has determined the presence of a toxic substance, this should be clearly indicated by means of colour coding or highly visible symbol. Such labelling should not contaminate the sample, and should be sufficiently resistant to degradation to avoid fading or tampering.

To ensure the safety of personnel handling the sample containers and packages, the external surfaces of containers and packages should be decontaminated with Fuller's earth, or other suitable decontaminant, prior to being taken from the sample site to the vehicle which will take them to the base camp.

4.2.5 Recording/Documentation

As each sample is collected, it should be recorded in a log book and the sample container labelled accordingly. All phases of sample collection, transportation, storage and analysis will have to be fully documented. In addition to written records, a photographic and/or video record would be useful. Still photographs (preferably one colour and one black and white) could be taken at the sample location of each sample. One camera could use polaroid film to protect against error or mishap. Similarly, a video camera with a built-in sound recording capability would also be a useful tool. (These will also be useful in identifying subjects who are interviewed and/or examined).

The most detailed record, of course, will be found in the log books. These will contain the following information:

- location of the sample site
- description of the sample site
- description (measurements and diagram) of the delineation of the site
- procedure and results of hazard survey
- grid system used to lay out the site for systematic sample collection
- identification of members of on-site inspection team and allocation of tasks/responsibilities
- identification of accompanying personnel
- climatic conditions, wind direction and velocity
- date, time and location of each sample with identification of member taking the sample (initials) and of member packaging the sample (initials)
- photographic documentation (identify means) (N.B. Pictures should preferably include identity tag or label and a scale or other object for comparison)

- details as to temporary storage procedures
- any special reasons for collecting a particular sample

4.2.6 Storage

At this stage, storage time is measured in hours, while the samples are being collected and then transported to the base camp. Cool storage should be provided as a general rule, if available. Insulated containers have to be available so that environmental and/or biomedical samples can be refrigerated, if required. Some samples may have to be kept in a frozen state.

All aspects of storage (and transport) should be documented.

5.0 Base Camp Analysis and Preparation for Distribution

5.1 Base Camp Analysis

It is anticipated that chemical weapons would be used in battle in such quantities that initial concentrations of chemical warfare agents would be very high. However, many of the agents will persist for only a few minutes or hours, while only a few will remain for longer periods depending on their nature and conditions of weather and terrain. When a limited number of weapons are used (for example, for harassing purposes), or when unconventional means for dissemination are employed, it is likely that initial concentrations would not fit the expected pattern and would be relatively low. In either case, sampling for the agents or their degradation products and their subsequent determination will be the more difficult the longer the time before these two activities can commence. Therefore, as has been mentioned, it is highly desirable that analysis for chemical warfare agents be performed as near as possible to the site and with a minimum of delay after the alleged event is reported.

A mobile, air transportable laboratory can be used effectively to provide analysis for chemical agents immediately following sample collection by using efficient methods for sample preparation and by applying techniques of thin layer chromatography (TLC) and capillary column gas liquid chromatography (GC). While a great amount of work has been done in recent years to develop highly sophisticated instrumental methods of analysis for trace quantities of contaminants in air, soil and water; these two methods have been highlighted here to provide a balance between reasonable cost, space and weight limitations and the

requirement for provision of extensive analytical data. The necessary instrumentation, equipment, reagents, solvents and gases for several days of operation can be efficiently packed into containers for airlift or for transportation by road. Electrical power as required for the operation of the mobile laboratory would be obtained from power mains if available or, if necessary, from a portable generator.

Base camp analysis will be performed with the following objectives in view:

(a) to support the operations of the sampling team by confirming the presence or absence of known chemical warfare agents in air, soil, vegetation or water samples, and

(b) to provide early information which can be used by the investigating team in preliminary assessment of an alleged event and assist it in deciding on the disposition of samples to designated laboratories for more extensive analysis.

5.2 Preparations for Distribution

Various preservation methods have been mentioned throughout the text. Briefly, these include the extraction of certain samples with chloroform, the fixation of tissue samples with formalin, and the maintenance of temperature requirements. It might be necessary to specify, for various types of agents or sample substances, the temperature and moisture conditions which should be maintained. For example, certain biological specimens, such as those possibly containing Fusarium fungi, might be able to produce toxins at lower temperatures, which were not present at the time of collection of the specimens.

5.2.1 Splitting of Samples

We have assumed, for illustrative purposes only, that apart from the analysis conducted in the base camp facility, each sample will then be divided into four parts: one part will go to each of three designated laboratories and one part will be retained and stored by the international authority for reference purposes.

In fact, more than three laboratories could be involved in analyzing the wide variety of samples. Not all laboratories will necessarily be able to deal with the full range of environmental and biomedical samples, in the search for chemical or biological warfare agents.

5.2.2 Spiking

The purpose for the spiking of samples with known quantities of known chemicals is to provide an objective assessment of the procedures and tests employed by designated laboratories. The reasons go beyond that, however. If the designated laboratories were consistent in having difficulty in detecting the chemicals in the spiked samples,

and if the spiked chemicals were the same or chemically similar to what may have been found during base camp analysis, this could provide a framework for assessing the results of analyses of the other samples. If the designated laboratories vary in their analytical results of the spiked samples, then this would cause one to look more closely at a variety of factors which could lead to such a variance: differences in handling procedures, tests, equipment, storage or transportation (which should be well documented), to mention the most obvious.

Some thought will have to be given to whether or not it will be desirable to spike certain control samples with known quantities of known chemical warfare agents. If such is the case, the investigating team will have to bring with it small quantities of certain chemical warfare agents of known purity (or, alternatively, their simulants).

The technical expert (base camp analyst) administering such known compounds should also be aware of their persistence and reactivity so as to know what should be expected from the analyses to be conducted by the designated laboratories.

Some consideration might also be given to the desirability of spiking all samples with a particular chemical for labelling purposes, so that tampering with packages and/or samples might be identified. Since there are various other checks in effect from start to finish of the operation, it is not clear that such an additional check is required or desirable.

5.2.3 Packaging

The report of the United Nations Group of Consultant Experts (see A/39/488 dated 2 October 1984) goes into some detail on the subjects

of sample packaging and handling, and also identifies the relevant international transportation regulations. This paper has already addressed these issues in sub-sections 3.3.2 and 4.2.4.

To summarize, all samples should be collected in Teflon or glass containers with Teflon-lined caps or Mylar bags without plasticizers. Samples should be packed airtight, thus necessitating, in the case of the use of bags, the removal of excess void space prior to sealing. It is recommended that double bagging be employed. In this case the first bag containing the sample is inserted into a larger bag with excess void space removed and the bag sealed. An identity tag or sticker should be affixed to the inner and outer sample container. The sample containers are subsequently packaged for transport to the designated laboratories in cardboard or fiberboard boxes, canisters or cans. To prevent breakage or puncture, at least 8-10 cm of protective material (vermiculite, styrofoam, excelsior or charcoal impregnated wadding) should be packed around the sample containers. Care should be taken if air transportation is used as high altitude pressure changes could potentially result in rupture of the containers due to pressure differentials. The box, can or canister should be sealed with tape in such a way that any tampering with the package will be readily visible. To ensure the safety of personnel handling the packages, the external surfaces of the sample container, as well as the shipping package, should be decontaminated with Fuller's earth or other suitable decontaminant.

Maintenance of temperature conditions, i.e. refrigeration or freezing of certain samples, may be of prime concern in preventing or

minimizing deterioration of the samples. The accompanying team member (expert or other team personnel) should be able to ensure the proper handling of samples by transport officials and staff and to reinforce measures should this be required. Temperature sensitive strips (indicating minimum/maximum temperatures while in transit or storage) may also be useful.

5.2.4 Labelling

An identification tag or adhesive label should be affixed to each sample container and package (see example at the end of this section). Adhesive labels may peel off under moist conditions, and are therefore only to be used if the material is not refrigerated. Indelible marking devices can be used to inscribe identification codes which will refer to the accompanying member (expert or other team personnel) and to the number corresponding to the log book entry (see section 5.2.5). The log book(s) will be carried by the team and copies of relevant sections will be turned over to the designated laboratories. There should also be labels on the packages indicating that the contents are (presumed to be) toxic; as well as providing any specific handling instructions and warnings as to the fragility of the contents. The relevant international transportation regulations, identified in the report of the United Nations Group of Consultant Experts, may have to be taken into account (see section 7.0).

Illustrative Identification Tag:

TOXIC

UN

LOGO

SHIP TO: _____

_____

_____

_____

CAUTION! DO NOT OPEN! IF FOUND ADVISE:

_____

_____

_____ TELEPHONE: _____

SHIPMENT DATE

_____

IDENTIFICATION

NO: _____

TOXIC

5.2.5 Recording/Documentation

Various log books will be maintained throughout the operation, and information will be transcribed a number of times requiring that considerable care be taken.

The on-site inspection team will maintain a log book for each sample site. The medical team members will each maintain log books relating to their sampling and medical examinations. Similarly, a log book will be kept of interviews and details about the administration of questionnaires will be recorded therein.

The base camp analyst will prepare a master log book of all samples, with an explanation of the codes used. It would simplify matters if the same codes could be used as those employed by the on-site inspection team and medical team members, thus there will be a need to standardize these procedures from the beginning. The base camp analyst will also prepare the log books which will accompany the packages to the designated laboratories and which will be left there with the packages. These log books will contain only that information considered useful for scientific analysis.

It is important to emphasize that a complete record will have to be maintained of the chain of custody of (i.e. access to) the samples so as to ensure they have not been tampered with.

The team's log books, including the master log book, will be collected by the team leader at the end of the operation and delivered to the international authority for safekeeping. This is also the case with respect to photographic and video documentation, tape recordings, medical documentation and questionnaires. Some of this information

will require further processing by designated team members, which will be arranged through the international authority.

5.2.6 Storage

Storage in the base camp will be the responsibility of the base camp analyst and a secure area will have to be identified for this purpose. Requirements for refrigeration have already been mentioned.

Samples may be stored up to a week at a base camp and then delivered to a holding point in the rear area (where they may possibly await the samples from a second sample site). However, it may be preferable to send all the samples from the first base camp immediately to the designated laboratories once such samples are assembled. A variety of factors may influence such a decision, but uppermost must be the need to avoid lengthy delays and, particularly, the deterioration of the samples.

The accompanying member (expert or other team personnel) will be responsible for the storage of samples in-transit, until such time as he officially hands them over to the designated laboratories.

6.0 Interviewing and Epidemiological Survey

6.1 Interviewing

6.1.1 Purpose

This section offers selected comments on ethnographic interview techniques in cross-cultural settings, and proposes a standardized questionnaire format to be used in compiling information with respect to an allegation of the use of chemical or biological weapons.

It is worth mentioning that the questionnaire to be found in sub-section 9.2 is meant to be an illustrative questionnaire, and is probably much more comprehensive than the interviewer would need. Of course, as is explained in the questionnaire, not all of its sections (Parts) would apply to all respondents, but rather only certain sections would apply. Finally, it is anticipated that the interviewer would carry a small number of "master" questionnaires, and a larger number of blank and numerically-coded response sheets so as to avoid the bulk involved in transporting a large number of questionnaires. It goes without saying that the intention would be eventually to transcribe data to a computer for detailed analysis.

6.1.2 Background

A fundamental problem in investigating an alleged case of chemical or biological warfare after the event is the collection and assessment of varied and incomplete information, from informants who are likely to have endured the major life crises and stresses associated with living in a war zone and who may since have fled their homes in order to seek refugee status. Such experiences, coupled with the passage of time, can lead to the omission of pertinent details from descriptions, and

possibly also to the embellishment of accounts or to generalizations from isolated events. To these difficulties should be added certain conceptual problems which may arise when the cultural backgrounds of respondents are totally different from those of the investigators.

Not to be forgotten, of course, is the possibility that respondents may dramatize, or even fabricate, their accounts to discredit the perpetrators of the attack or to gain some favour - be it access to medical attention, refugee status or another form of gain. Thus, in life-or-death situations, information might be coloured by self-serving motives. As a result, the social background of the respondents and their motives for providing testimony could become factors in establishing the plausibility of accounts. This also highlights the importance of attempting to cross-reference accounts from a variety of respondents who may have re-located in different camps or areas.

There are technical as well as practical difficulties involved in the assessment of information provided by respondents. As an example of the technical difficulties, the alleged perpetrator of a chemical attack could be purposely trying to create the impression of the use of some novel or unknown substance where there is none, as a form of psychological warfare. The perpetrator could alternate attacks with and without chemical weapons, heightening fear and panic while reducing the chances of investigators actually collecting a sample of the agent. Furthermore, false alarms can contribute to overwhelming any investigative mechanism.

Other practical problems could derive from the symptomatology associated with certain chemical weapons which could be very similar

to indigenous or self-inflicted health problems. It is a fact that the human or animal body and the various bodily systems have only a finite number of ways to respond to injury. The onset and pattern of signs and symptoms may conform to a known or suspected CBW agent, but the diagnosis can be problematic when the symptoms are nonspecific and thus give rise to the possibility they are related to other causes or factors. Symptoms such as dizziness, insomnia, vomiting or weakness may be part of the intoxication with a CBW agent or they may be psychosomatic symptoms associated with the stresses of either living in a war zone or of being involved in an attack that is chemical, biological or psychological in nature. Moreover, the symptoms may be attributable to the person's past medical history, especially in some rural areas where tuberculosis, malaria, cholera or parasitic diseases might be prevalent. In some countries, substances with certain hallucinogenic effects are used, and there is the possibility that some symptoms could be due to such use rather than to the alleged incident.

Epidemiological studies (as discussed later in this section), making statistical comparisons between the reported symptoms of a control group and a group under study, can be employed indirectly to link the symptoms to certain suspect agents. Insofar as each family of chemical agents provokes certain combinations of signs and symptoms among its victims, an epidemiological dimension to the investigation is helpful in the identification of the family of agents. Such an assertion does not deny that there are certain practical problems which must be borne in mind, including that of obtaining reliable medical information retrospectively. Furthermore, there are problems associated with

interviewing people who, more than likely, do not share the interviewer's classifications of the senses, of symptoms, or of diseases. The translation and interpretation of reported symptoms can be problematic, especially when the investigator is dealing with pre-literate people.

Accounts of animal symptoms and deaths as well as accounts of changes in vegetation are another important source of information, since in these cases psychological reactions can be ruled out. The onset of signs and symptoms among animals of different sizes, as well as their sequence and death rates, can provide objective evidence helping to identify a family of chemical agents. Likewise, the sequence of changes in various types of plants, and the onset and timing of physiological symptoms in both humans and animals who ingest those plants, provide independent evidence of toxic substances which could prove unique.

Other evidence of attacks with chemical or biological weapons may be available from the medical records of victims who have been examined by physicians or from pathological, bacteriological or toxicological tests performed on human or animal tissue and on plant samples. Medical records, where available, can corroborate accounts of symptoms while clinico-pathological tests or postmortem specimens can verify the presence of toxic chemical substances. However, the identification and confirmation of the presence of a toxic agent is an arduous task beset with difficulties. The possibility that small quantities of toxic substances may occur naturally in the environment leads to questions about "background" levels and, possibly, about the sensitivity to variations in those levels.

All of these complex issues must be borne in mind in any attempt to devise a questionnaire which will contribute to an objective assessment of what may have transpired. The questionnaire, interviewing techniques and investigators must all be able to stand up to careful scrutiny.

6.1.3 Development and Description of a Questionnaire

The evaluation of information compiled during interviews will inevitably involve an assessment of the credibility of the respondents, their accounts of the attack, their descriptions of any strange substances and their accounts of their symptoms. The questionnaire must include appropriate questions so that the reliability of the evidence can be assessed. The following discussion attempts to indicate the types of evidence that can be collected and the degree of certainty that may be attached to each in attempting to determine what transpired.

In the illustrative questionnaire (sub-section 9.2) socio-demographic data (Part 2, Questions 1-17; Part 3, Questions 1-14; Part 5) directly and indirectly relate to the credibility and reliability of the respondent's testimony. Greater certainty will be attributed to the testimony of those present during an attack than to the accounts of individuals who were not present or who report hearsay information. Greater certainty also will be given to the testimony of "independent observers" than to that given by combatants; and evidence from expert witnesses (e.g., pathologists) will be more credible than either of the former. More specifically, socio-demographic data will provide the information necessary to assess the reliability of the respondents' reports: greater certainty will be attributed to reports from a cross section of individuals of varying kinship, as well as varying socio-economic,

religious, ethnic or military backgrounds, and so on. Since it can be assumed that individuals of similar backgrounds share similar lifestyles and have similar rates of morbidity and mortality, the socio-demographic data are also to be used as criteria in the selection of individuals for control groups in epidemiological studies.

Evidence of an attack may be viewed as a function of the respondents' credibility and the degree of unanimity among eye-witness accounts of the time, place, weather conditions, type and mode of delivery (Part 4, Questions 1-34). The closer the agreement over the essential details such as time and mode of delivery, the more strength can be given to the evidence. Independent military experts can also be used to assess details to determine the plausibility of the attack.

Military experts will likely be aware of the attacker's normal methods of conventional operations, and will also be aware of how these would likely change if toxic substances were used. Thus, details of the attack, if available, would be helpful.

The interviewer will also be particularly interested in knowing, if a novel substance is suspected, whether descriptions of the substance agree with respect to colour, odour, viscosity and tactile sensation (Part 4, Questions 31-36). Once again, the greater the agreement among the descriptions of such a substance, the more likely it is that some form of chemical or psychological warfare attack took place.

The symptoms of the afflicted should be clinically consistent among individuals (Part 4, Questions 38-39). The onset of the symptoms (time after attack) should be roughly the same for different individuals, within the limits of biological variation and dosage, assuming a point

source for the agent (Part 4, Questions 39-44). This would provide quite strong evidence of causality. The onset of symptoms must follow the reported attack and, the closer together the incidence in different individuals, the more likely it is that they were due to an agent. Where the signs and symptoms are clinically consistent among individuals, the more likely it is that they are attributable to a unique family of agents. Corroborative evidence obtained from medical examinations and medical records (Part 6, Questions 1-7) provides greater certainty than that obtained from the reports of respondents. Symptoms that can be shown to be more physiological in origin (e.g., vomiting with blood) will provide more certainty of a CBW attack than will symptoms that can be shown to be psychosomatic in origin (e.g., insomnia, "nervousness"). Practically, a comparison of symptoms involves case control studies and/or the cross checking of information from different victims with due attention to preventing respondents from discussing their accounts with other people about to be interviewed (Part 4, Questions 85-86).

The investigator will be interested to know whether morbidity and mortality within and among villages coincides with a pattern of CBW attacks given the point of source and the direction of prevailing winds and weather conditions (Part 4, Questions 11-16). The geographic delineation of cases would be of considerable interest.

Among those with clinical symptoms, it is possible that the symptoms may be related to a pre-existing medical condition that rendered the respondent susceptible or that brought about the onset of the present condition. Alternatively, the observed symptoms may be psychosomatic responses to stressful life changes or hysterical responses to the

attack (Part 3, Questions 10-14). The elimination of these factors as possible explanations can be examined in epidemiological studies comparing case and control groups. Eliminating such factors serves to increase the certainty that the symptoms can be attributed to a particular event.

Disease among animals of different size, as well as their sequence and rates of death (Part 4, Questions 53-59, 67-71) or in plants (Part 4, Questions 60-66), provide relatively objective indications of what may have been a CBW attack. Where the onset and sequence of symptoms and death in plants and animals conform to the syndrome provoked by a family of chemical warfare agents, such evidence will be of particular interest. Again, where verbal reports are utilized, the closer the agreement and the more biologically plausible the reports, the greater the confidence that can be placed in the information. Testimony of "independent observers" who have visited the site of an attack shortly after the incident would also be useful. Results of pathological tests performed on tissues, or samples of the alleged substance, clearly would be of great importance to the investigation (Part 6).

The role of the interviewer and translator will be crucial as they attempt to collect objective and relevant information. It is advisable that the interviews be conducted by a medical practitioner with experience in epidemiology and/or an anthropologist or another behavioural scientist with cross-cultural interviewing experience. The quality of the data will depend upon the knowledge and cultural sensitivity of the interviewers and, to an even greater extent, it will depend upon the quality of the translator who must know the respondent's semantic

domains. Interviewer bias is likely to occur where the interviewer and interpreter are seen by the respondents as authority figures. Therefore, it is not advisable to use local government officials and military personnel in these roles. Part 1 of the questionnaire provides the investigators with some criteria for assessing the interpreter and ultimately provides some measure of confidence in the data.

The questionnaire that has been developed takes the form of a semi-structured interview in order to demonstrate the types of information that may be collected. In practice, the interviewer should pose the questions in a manner that allows the respondent to describe his/her experiences with minimal direction and prompting. The semi-structured questionnaire thus serves as a guide or a mechanism to ensure that adequate information has been obtained for assessing the evidence.

Different languages create and express different realities. People categorize experiences differently and provide alternative patterns for customary ways of thinking and perceiving. In collecting cross-cultural data, these differences present obstacles, some of which are easier to overcome than others. For example, differences in the reported colour of an alleged CW agent may be due to variations in memory or to cultural differences in the perception - and hence the translation - of colours. This being the case, the use of standardized colour charts is advised.

Concepts of time vary cross-culturally and, even within a country, concepts vary according to one's exposure to the outside world. As far as possible, the interviewer should endeavour to elicit and understand

native terms and categories of time before beginning to gather specific information.

To ascertain the mode and type of vehicle used in an alleged attack, it is advised that photographs be available for identification purposes. Line drawings in such contexts are not advised because many pre-literate people cannot recognize two-dimensional graphic representations.

Because of cultural variations, it is advised that the questionnaire be translated before data collection is begun and that the same terms be employed by all translators. The translation should be validated by another independent translator, to ensure that the translation is not ambiguous in any part. It is advisable that native terms plus literal translations of the words be recorded for consistency of responses and accuracy in understanding the terms.

6.2 Epidemiological Survey

Epidemiology is the study of the distribution and determinants of disease in human populations.

Through the use of a detailed questionnaire, the presence of various signs and symptoms is determined in both a control group and the group under study. Deviations from the norm may then be identified and statistical analysis used to reveal the causal mechanisms involved. Since certain symptoms or combinations of symptoms may be unique to a particular family of chemical or biological warfare agents, it may be possible in this way to provide some focus to the investigation. Beyond this, it should be possible to determine in statistical terms the degree to which health problems related to an alleged attack with chemical or biological warfare agents are an aberration from the norm, that is, from other health problems prevailing in the region.

The epidemiological approach embraces two distinct phases. First is the data collection phase which is essentially descriptive in nature. Nevertheless, this phase includes the generation of hypotheses as to cause and effect, which is achieved primarily by defining a case and examining patterns of disease occurrence with respect to persons, time and place. The second phase is the analytical phase, the purpose of which is to test the hypotheses previously set forth.

The epidemiologist will wish to know about the normal occurrence of health problems in the area under investigation. To determine whether the frequency of a disease is an unusual event, the epidemiologist must compare the observed frequency with the usual or expected frequency of the disease for that population. Since the expected frequency is

seldom known, the rate of the disease in the study population must be compared with that in a control or comparison group. The control group can be chosen by selection of groups which resemble each other as closely as possible.

Such a case-control study looks at the health problems from two points of view. Persons who may have been exposed to a suspect substance can be studied to see if they develop adverse reactions, or persons who display adverse reactions can be studied to see if they have been exposed to a suspect substance. This situation is known as a 2 x 2 contingency table (see Table at the end of this sub-section). In a 2 x 2 contingency table, data are arranged in a "yes or no" situation, both for the exposure (exposed versus non-exposed) and for the outcome (diseased versus non-diseased).

The epidemiologist will design a study to determine the values for each cell of the 2 x 2 table. Once this is done, an appropriate statistical analysis can be performed in order to determine whether there is an association between the exposure and the adverse health outcome. The purpose of this analysis is to test whether the association is significant. "Significant" implies that if an association is found, it is unlikely to have occurred by chance (sampling variation) alone.

The epidemiological approach cannot, by itself, prove that chemical or biological weapons have been used; nor can it identify the specific substances that may have been used. It can, however, provide powerful supporting evidence to other elements of the investigation. Perhaps the greatest utility is in providing a methodology for the collection, analysis and interpretation of the information and data. Through a

feedback mechanism, this activity should provide guidance to the team in its collection of physical samples. Relevant to this is the questionnaire that will be administered by team members and which was discussed in the previous sub-section.

Table: 2 x 2 Contingency Table

Exposure to Suspect Substance	Disease: Yes	Disease: No	
Yes	a	b	a+b
No	c	d	c+d
	a + c	b + d	

a = Number of individuals who have been exposed to the suspect substance and have developed the disease/adverse health effects.

b = Number of individuals who have been exposed to the suspect substance but have not developed disease/adverse health effects.

c = Individuals who have not been exposed to the suspect substance but have developed the disease/adverse health effects.

d = Individuals who have neither had exposure nor disease/ adverse health effects.

a+b = All individuals who have been exposed.

a+c = All individuals with disease/adverse health effects.

b+d = All individuals who have not developed disease/adverse health effects.

c+d = All individuals who have not been exposed.

a+b+c+d = All individuals surveyed.

7.0 Transport

The report of the United Nations Group of Consultant Experts examined this issue in some detail in terms of identifying the relevant international transportation regulations (see A/39/488 dated 2 October 1984, pp. 31-32, 52-52).

In view of the bulk, quantity and nature of the samples, it may be the case that the international authority may consider the simplest and best approach to be one of requesting assistance in the form of military air transport from a specific country. This would undoubtedly reduce delays in delivering the samples to the designated laboratories, reduce any hazard which might accompany repeated handling of the samples, and increase security.

If commercial aircraft service has to be used, every effort has to be made to discuss, in advance, the specific transport and handling measures with the airline(s) involved.

8.0 Designated Laboratory Analysis

In the context of a future chemical weapons convention, it is reasonable to expect that the international technical secretariat will establish its own highly-specialized laboratory facility to conduct detailed analyses of a full range of environmental and biomedical samples. Even so, there may be a requirement to have other designated laboratories analyze the same samples, although this might involve less than the three designated laboratories which this Handbook assumes.

Under current circumstances, greater reliance would be placed on the analytical capabilities of the designated laboratories. These ought to be highly specialized laboratories equipped with the most sophisticated instrumentation available as well as technical expertise so that a wide range of ultrasensitive analyses can be conducted on the samples. Samples to be analyzed are submitted to the designated laboratory coded (to prevent subjective analysis) and sealed (to preclude tampering with the samples during transit).

The tasks of the designated laboratory are threefold:

- identification of any currently known chemical or biological warfare agents;
- verification of the results of any preliminary analyses; and
- elucidation of the structures (nature) of unknown agents.

The chemical analytical techniques which should be available at the designated laboratory include: gas chromatography (including retention index monitoring); high performance liquid chromatography; mass spectrometry; infrared and nuclear magnetic resonance spectrometry; enzymatic analysis (especially analysis of the inhibition of cholinesterase

enzymes); and immunological methods (e.g., radioimmunoassay, fluoro-immunoassay and enzyme immunoassay). Of additional interest are physical techniques (e.g., electron microscopy) and toxicological analysis using test animals. All analyses must be conducted in the spirit of "Good Laboratory Practice" regulations (GLP).

The microbiological techniques which should be available at the designated laboratories are too many to be listed here. What is important, though, is that the laboratories have a proven track-record of continuous, reliable identification of unknown disease-causing agents.

8.1 Receipt/Recording/Documentation

When the samples and appropriate copies of log books are delivered to the designated laboratories, the accompanying personnel (expert or support personnel) will obtain a signature from a person in authority on a document which will:

- detail the packages delivered and the sample containers in each package, according to a code;
- indicate the condition of the packages;
- indicate, in general terms, the condition of the sample containers (particularly those that were refrigerated or frozen); and
- indicate the minimum/maximum temperatures that may have been recorded on temperature-sensitive strips affixed to the packages.

Any aberrations (damage, evidence of tampering) should be documented and/or photographed for the record.

8.2 Reporting

Data obtained from the chemical analysis of suspected CBW agent samples, first and foremost, should be recorded according to GLPs. A computerized information management system is ideal for the storage of raw data, provided sufficient back-up is available. Further, computerization of data prevents the intermixing of data from different samples as well as allows for the rapid examination of the results from the various chemical analyses. Computerization also allows for the comparison of chromatograms, spectra and other parameters with those of known CW agents and with materials of no CW interest. This latter use of computerization assists in the efficient and rapid identification of CW agents in samples.

In order to allow for a rapid appraisal and comparison with other reports, the designated laboratories should be instructed to report their results in a standardized manner.

This report should include:

- description of the condition in which the samples were received;
- details of analytical methods used, e.g., type of instrument and detection limits, preferably with literature references if the method is an officially recognized one;
- description of sensitivity and resolution in standard (internally) spiked samples for known chemicals;
- details of findings on each sample; and
- conclusions.

All these chapters should be written in a language which is, by and large, understandable by lay persons. Detailed scientific information and documentation, such as copies of tracings and recordings, should be included in appendices.

8.3 Storage

Many independent laboratories hold samples for 1-3 years past submission of a final report if legal proceedings are in progress or are likely. They are then available for re-analysis, should that be considered necessary or desirable. The designated laboratories should store the samples in accordance with such requirements, paying particular attention to the security of the samples. The samples should not be destroyed or in any way disposed of without first obtaining the permission of the international authority. At some point, the international authority may decide to re-group the samples in a central facility, or it may authorize their disposal.

9.0 Appendices

9.1 Fact Sheets

9.1.1 Chemical Warfare Agents - Examples

9.1.2 Potential Biological Warfare Agents - Examples

9.2 Illustrative Questionnaire

9.1 Fact Sheets

9.1.1 Chemical Warfare Agents - Examples

Lethal/Choking Agent:	Phosgene Chloropicrin
Lethal/Blister Agent:	Mustard Lewisite
Lethal/Blood Agent:	Hydrogen Cyanide Cyanogen Chloride
Lethal/Nerve Agent:	Tabun Sarin Soman VX
Lethal/Toxin:	Botulinal Toxins Staphylococcal Enterotoxin B Trichothecene Mycotoxins
Incapacitating/ Psychochemicals:	BZ LSD
Harassing/Lachrymator:	CN CS
Harassing/Sternutator:	Adamsite Diphenylchlorarsine Diphenylcyanarsine
Anti-Plant Agent/ Herbicide	
Anti-Plant Agent/ Soil Sterilant	

Lethal/Choking Agent (Lung Injurant)

WELL-KNOWN EXAMPLES:

Phosgene ($COCl_2$) Chlorine (Cl_2) Chloropicrin (Cl_3CNO_2)

Diphosgene ($ClCOOCCl_3$) Ethyldichloroarsine ($C_2H_5AsCl_2$)=ED, also a blister agent

GENERAL INFORMATION ON PROPERTIES/CHARACTERISTICS:

- may be liquid or vapour at environmental temperatures
- characteristic odours
- hazard duration measured in minutes to a maximum of a few hours
- many industrial intermediates could be classified as lung injurants

GENERAL INFORMATION ON TOXICOLOGY/SYMPTOMATOLOGY:

- may cause damage to the respiratory tract, as well as to the lung capillaries causing pulmonary edema
- inhalation may cause transient irritation of mucous membranes of the eyes and respiratory tract
- symptoms may be immediate but also may not be experienced for some time (hours) after inhalation and, depending on dosage, could include: breathlessness, cough, dyspnea, vomition and other gastrointestinal tract (GIT) effects, pain in chest, cyanosis, conjunctivitis, frothing at the mouth, disorientation, convulsions, cardiac arrest

CAUTIONS:

- Protection required: military-style gas mask if hazard is recent

FIRST-AID/THERAPY:

- keep patient quiet and warm
- irrigate eyes if severely affected
- treat as for bronchial pneumonia or pleurisy
- give oxygen in severe cases

Specific examples follow

AGENT: Phosgene $COCl_2$ (Carbonyl chloride)

PROPERTIES/CHARACTERISTICS:

- melting point: -118°C boiling point: 8.2°C
- denser than air
- volatility at 20°C: 6,300,000 mg/m^3
- odour: in low concentrations - sweet, not unpleasant, like fresh-cut hay; in high concentrations - pungent and irritating
- hydrolyzes rapidly
- industrial chemical

TOXICOLOGY/SYMPTOMATOLOGY:

- casualty dosage (unmasked): 1600 $mg\text{-}min/m^3$
- lethal dosage: 3200 $mg\text{-}min/m^3$
- initial effect: transient irritation of mucous membranes, especially eyes and respiratory tract
- symptoms may not be evident for some time (hours)
- symptomatology: bronchiolar constriction, cough, chest pains, cyanosis, mental disorientation, convulsions, coma, cardiac arrest

CAUTIONS:

- phosgene causes a "tobacco reaction" in that men who have breathed slight amounts of phosgene may experience a flat metallic taste when smoking tobacco
- because phosgene hydrolyzes rapidly, extra caution should be shown to unexploded shells in a humid/wet environment (pressure build-up)
- the injurious effects of phosgene are significantly increased by physical exertion
- Protection required: military-style gas mask if hazard is recent (hours)
- due to its insidious nature, any exposure should be dealt with as being injurious

FIRST-AID/THERAPY:

- there is no antidote; treatment is essentially palliative and supportive
- all exertion is to be avoided
- loosen clothing and provide warmth
- copious quantities of fresh air
- administer oxygen in severe cases
- administer heart stimulants
- treat like pleurisy

- Neutralization/Decontamination: steam and water hydrolyzes phosgene, and alkalies and amines react with it

AGENT: Chloropicrin Cl_3CNO_2 (Trichloronitromethane)

PROPERTIES/CHARACTERISTICS:

- melting point: -69.2°C boiling point: 112°C
- denser than air
- volatility at 20°C: 170,000 mg/m^3
- odour: sweetish, like flypaper
- quite stable; hydrolyzes with difficulty
- decomposes upon heating
- agricultural chemical

TOXICOLOGY/SYMPTOMATOLOGY:

- casualty dosage (unmasked): 0.7mg/m^3 (threshold limit value)
- lethal dosage: 20,000 $mg\text{-}min/m^3$
- symptoms (concentration-dependent):
  at low concentrations produces lachrymation as well as nausea, vomition, colic and diarrhea
  at high concentrations produces nasal, throat and lung irritation
- GIT effects can persist for weeks

CAUTIONS:

- on open ground chloropicrin is persistent (1 hr. during the summer and 12 hrs. during the winter)
- Protection required: military type protective mask

FIRST-AID/THERAPY:

- wash eyes with boric acid
- keep patient warm
- protect throat from infection
- provide supportive treatment for GIT effects

- Neutralization/Decontamination: sodium sulfite solution

Lethal/Blister Agent (Vesicant)

WELL-KNOWN EXAMPLES:
- Bis(2-chloroethyl)sulphide $(ClCH_2CH_2)_2S$ - Mustard (HD)
- 2-Chlorovinyl dichloroarsine $(ClCH{:}CHAsCl_2)$ - Lewisite (L)
- 1,2-bis(2-chloroethylthio)ethane - Sesquimustard (Q)
- bis-[2-(chloroethylthio)ethyl]ether - Dimustard ether (T)

GENERAL INFORMATION ON PROPERTIES/CHARACTERISTICS:
- may be solid or liquid at environmental temperatures
- some characteristic odours
- hazard duration measured in days or weeks, depending on climatic conditions
- reactivity with water (hydrolysis) varies
- generally high boiling point, low vapour pressure, low volatility

GENERAL INFORMATION ON TOXICOLOGY/SYMPTOMATOLOGY:
- vesicants produce multiple physiological effects (e.g., may be lachrymatory or lung injurant/irritant) and are often systemic toxic
- onset of symptoms and effects varies from minutes to a few hours
- toxic effects produced through inhalation, contact and percutaneous absorption
- earliest effects may be on eyes, leading to conjunctivitis and temporary blindness
- other symptoms: nasal secretion, sore throat, coughing, nausea, skin rash, blistering, fever, rapid pulse, perspiration; often leads to bronchopneumonia

CAUTIONS:
- due to insidious nature and persistency, gas masks and special protective clothing should be worn
- low temperatures slow down volatilization, giving the impression of a reduced hazard which may increase as the environmental temperature increases
- mustard hydrolyzes slowly and retains toxic properties in water
- burning of contaminated materials may release large quantity of toxic vapour
- liquid and vapour will penetrate ordinary (untreated) clothing, even rubber and leather boots

FIRST-AID/THERAPY:
- wash immediately with an appropriate solvent (which may be kerosene, gasoline or oily solvents) and then wash and scrub with hot water and soap
- Lewisite requires further measures to counter the intravenous absorption of arsenic: application of 5 percent aqueous solution of sodium hydroxide
- serious danger of subsequent infection, particularly of blistered areas: treat as serious skin burns

Specific examples follow

AGENT: Mustard $(ClCH_2CH_2)_2S$ (HD)

PROPERTIES/CHARACTERISTICS:

- melting point: 14°C boiling point: 217°C
- denser than air
- volatility at 20°C: 610 mg/m^3
- odour: like garlic or horseradish (may not be detectable at low casualty-producing concentrations)
- hydrolyzes slowly and remains active even if covered by water

TOXICOLOGY/SYMPTOMATOLOGY:

- casualty dosage (unmasked): 200 $mg\text{-}min/m^3$
- lethal dosage: 1500 $mg\text{-}min/m^3$
- initial effect: within a period of approximately one hour, low concentrations may result in conjunctivitis or inflammation of the eyes
- symptoms may not appear for hours after exposure, and could include: erythema of the skin, blistering or ulceration; inflammatory reaction of the nose, throat, trachea and bronchi

CAUTIONS:

- ordinary clothing contaminated by liquid or vapour should be removed immediately and, after personal hygiene/first-aid, fresh clothes put on
- buildings, equipment, terrain, may require repeated decontamination
- cool temperatures may give the impression of no hazard due to lack of vapour, but hazard may reappear at higher temperatures
- burning of contaminated materials may result in serious vapour hazard
- mustard is highly persistent, particularly in woods and in cool/cold weather, lasting days to weeks

FIRST-AID/THERAPY:

- contact with liquid or vapour should be dealt with by washing with kerosene or gasoline, followed by scrubbing with hot water and soap
- treat affected areas as for serious burns
- Neutralization/Decontamination: Calcium hypochlorite is usually used in the form of a slurry in water to avoid flaming which occurs when dry material comes in contact with the agent. Chloride of lime, also known as calcium hypochlorite or bleaching powder, reacts quickly with mustard forming a nonvesicant compound. Aqueous solutions of sodium sulfide, and solutions of bicarbonate of soda and sodium hypochlorite, can also be used. Clothing may be steamed or boiled, then allowed to aerate. Equipment may be cleaned with appropriate solvents and dusted with bleaching powder

AGENT: Lewisite (L) $ClCH{:}CHAsCl_2$ **(2-Chlorovinyl dichloroarsine)**

PROPERTIES/CHARACTERISTICS:

- melting point: -2.4°C boiling point: 197°C
- denser than air
- volatility at 20°C: 4,500 mg/m^3
- odour: like geraniums but at higher concentrations quite irritating
- hydrolyzes readily with evolution of a highly toxic oxide
- decomposition is accelerated with heat

TOXICOLOGY/SYMPTOMATOLOGY:

- casualty dosage (unmasked): 300 $mg\text{-}min/m^3$
- lethal dosage: 1300 $mg\text{-}min/m^3$
- quicker acting than mustard
- both a vesicant and a systemic poison
- initial symptoms: stabbing pain in eyes and a burning pain in skin and respiratory tract
- subsequent symptoms (due to oxide formation): systemic poisoning typical of arsenical compounds with liver, kidneys and red blood cells, in particular, being affected

CAUTIONS:

- minimum irritating effect is far below minimum concentration at which it can be detected by odour
- dangerous for long periods of time due to persistence of hydrolysis products (oxides) which retain same physiological properties as Lewisite
- readily penetrates clothing, leather, rubber and tissues of body
- Protection required: gas mask and best of protective clothing

FIRST-AID/THERAPY:

- wash skin with oils, then hot water and soap
- eyes should be bathed in physiological saline or in an eyebath
- injuries to the skin should be treated like burns
- systemic poisoning can be effectively treated with BAL (British Anti-Lewisite; 2,3-dimercapto-1-propanol or "dimercaprol") which is administered as an oil suspension intramuscularly

- Neutralization/Decontamination: Lewisite is almost immediately decomposed in the presence of alkalies (e.g., caustic soda, 5% solution, or ammonia) and by active oxidants (e.g., chloride of lime and the hypochlorites). Alcoholic sodium hydroxide spray is also effective

Lethal/Blood Agent

WELL-KNOWN EXAMPLES:

Hydrogen cyanide (HCN)
Cyanogen chloride (ClCN)
Cyanogen bromide (BrCN)

GENERAL INFORMATION ON PROPERTIES/CHARACTERISTICS:

- solid, liquid or vapour at environmental temperatures
- highly volatile and, therefore, relatively non-persistent
- interfere with cell respiration; block oxygen uptake from the blood or exchange of CO_2 between blood and tissues and between blood and air in lungs
- CN^- binds cytochrome oxidase molecule

GENERAL INFORMATION ON TOXICOLOGY/SYMPTOMATOLOGY:

- relatively low threshold of action; extremely toxic
- symptoms may be immediate or persist for 1 hour or more
- central nervous system (CNS) toxicants
- effects include progressive sensation of warmth; prostration; nausea; vomition; headache; dizziness; difficulty in breathing; unconsciousness; asphyxial convulsions
- cyanogen chloride has additional lung irritant properties with pulmonary edema occurring at sublethal exposures

CAUTIONS:

- insidious in action, causing practically no premonitory symptoms until serious poisoning has ensued
- toxicity follows extremely rapid course
- saturation of charcoal filter in gas mask possible
- Protection required: gas mask with filter containing silver oxide

FIRST-AID/THERAPY:

- artificial respiration and oxygen
- supportive therapy of symptoms
- eliminate CN^- from blood with use of thiosulfate, nitrites or cobalt
- administer antidote as soon as possible to ensure successful treatment

Specific examples follow

AGENT: Hydrogen Cyanide (HCN)

PROPERTIES/CHARACTERISTICS:

- melting point: -15°C boiling point: 26°C
- less dense than air
- volatility at 20°C: 891,000 mg/m^3
- odour: like bitter almonds
- vapour is exceedingly volatile and detectable in open only a few minutes
- stabilizers added to reduce volatility: stannic chloride and chloroform ("Vincennite"); or arsenic trichloride ("Manganite")
- miscible with water and slowly decomposes
- industrial chemical

TOXICOLOGY/SYMPTOMATOLOGY:

- casualty dosage (unmasked): 2-5000 $mg\text{-}min/m^3$
- lethal dosage : 2-5000 $mg\text{-}min/m^3$
- size of the casualty and lethal dosages vary widely according to the exposure time
- effects not apparent until lethal doses are achieved
- readily absorbed into circulation through lungs
- CNS toxicant
- symptoms (concentration-dependent): at low concentrations (effects prolonged for one or more hrs.) produces immediate and progressive sensation of warmth; prostration; nausea and vomition; headache; difficulty in breathing; unconsciousness; asphyxial convulsions. At high concentrations produces sudden loss of consciousness and death from respiratory arrest

CAUTIONS:

- HCN causes a "tobacco reaction" as per phosgene
- effects follow extremely rapid course if high concentrations are achieved
- tendency to inflame when disseminated by explosive burst
- charcoal filters can become saturated with HCN more readily than with other CW agents
- Protection required: gas masks fitted with canisters containing silver oxide

FIRST-AID/THERAPY:

- initial treatment involves administration of artificial respiration and oxygen
- subsequent treatment aimed at dissociating CN^- from cytochrome oxidase molecule; therapies include administration of sodium thiosulfate (to aid activity of rhodanese), sodium nitrite (to produce methemoglobin) or cobalt (to form complex with CN^-)
- antidotes should be administered as soon as possible

- Neutralization/Decontamination: none necessary

AGENT: Cyanogen Chloride ClCN

PROPERTIES/CHARACTERISTICS:

- melting point: -6°C boiling point: 13.1°C
- denser than air
- volatility at 20°C: 1,002,000 mg/m^3
- slightly soluble in water
- decomposed by moisture into hydrogen cyanide and hydrochloric acid

TOXICOLOGY/SYMPTOMATOLOGY:

- casualty dosage (unmasked): 7000 mg-min/m^3
- lethal dosage : 11,000 mg-min/m^3
- both blood agent and lung injurant
- symptoms: initially - immediate eye irritation and lachrymation; subsequently irritation of nose and throat; cough, tightness of chest; dizziness; increasing dyspnea; convulsions; retching; involuntary urination and defecation; unconsciousness; respiratory failure
- if death does not occur, signs of pulmonary edema may develop

CAUTIONS:

- strongly irritating to eyes and respiratory passages at low concentrations
- hydrogen cyanide is one of its decomposition products so care must be taken to prevent HCN exposure
- protection required: military type protective mask

FIRST-AID/THERAPY:

- treatment is palliative and supportive
- in severe cases, treat as per hydrogen cyanide

- Neutralization/Decontamination: none necessary

Lethal/Nerve Agent

WELL-KNOWN EXAMPLES:

Tabun	GA	Ethyl dimethylaminophosphonocyanidate
Sarin	GB	Isopropyl methylphosphonofluoridate
Soman	GD	Pinacolyl methylphosphonofluoridate
VX		Ethyl-S[2-diisopropylaminoethyl]-methylphosphonothioate
Carbaryl	Sevin	1-Naphthyl methylcarbamate

GENERAL INFORMATION ON PROPERTIES/CHARACTERISTICS:

- organophosphorus (G and V agents) or carbamate (eg. Carbaryl) compounds
- inhibit acetylcholinesterase either reversibly (carbamates) or irreversibly (organophosphates)
- G agents attractive due to ease of dissemination
- solubility in water varies
- range from highly persistent to non-persistent compounds

GENERAL INFORMATION ON TOXICOLOGY/SYMPTOMATOLOGY:

- G agents: can cause death in 1-10 min; can produce casualty effects dermally and at sublethal dosages
- V agents: equally as toxic as G agents by inhalation; more rapidly acting and at lower concentrations than G agents following dermal exposure
- Carbamates: less acutely toxic than organophosphates
- route of exposure determines rapidity with which symptoms appear following organophosphate exposure; inhalation is most rapid (within 1 min) followed by dermal exposure (½-1 hr)
- symptoms: headache; increased salivation and nasal secretion; bronchoconstriction; difficulty in breathing; gastrointestinal tract (GIT) effects; increased perspiration; effects on skeletal musculature

CAUTIONS:

- contact hazard on ground, vegetation and equipment is possible
- Protection required: gas mask and protective clothing
- clothing should be decontaminated and skin washed thoroughly if exposure is suspected

FIRST-AID/THERAPY:

- artificial respiration and oxygen
- atropine-oxime therapy (especially 2 mg atropine + 150 mg obidoxime chloride in an autoinjector)
- supplemental administration of muscular relaxation medicines may be helpful
- immediate administration of appropriate therapy is essential
- prophylactic treatment with pralidoxime (2-PAM) is recommended if exposure to organophosphates is anticipated but not in the case of exposure to carbamates

Specific examples follow

AGENT: Tabun (GA) Ethyl Dimethylaminophosphonocyanidate

PROPERTIES/CHARACTERISTICS:

- boiling point: 280°C
- volatility at 20°C: 300 mg/m^3
- moderately soluble in water
- least toxic of the G nerve agents
- inhibits acetylcholinesterase, thus disrupting nerve impulse transmission
- fairly persistent; contact hazard on ground, vegetation and equipment is possible

TOXICOLOGY/SYMPTOMATOLOGY:

- casualty dosage (unmasked): 300 $mg\text{-}min/m^3$
- lethal dosage: 400 $mg\text{-}min/m^3$
- more toxic if it enters body via contaminated food or water than if it is absorbed dermally
- Symptoms (concentration-dependent): at low concentration produces miosis; headache; increased salivation; increased nasal secretion; bronchoconstriction. At high concentration produces cough; greater difficulty in breathing; increased perspiration; GIT effects (nausea; vomition; colic; diarrhea); effects on skeletal musculature; death by suffocation due to effects on respiratory musculature and respiratory centre in central nervous system

CAUTIONS:

- avoid consumption of contaminated food and water
- Protection required: gas mask and protective clothing
- clothing should be decontaminated and skin washed thoroughly if Tabun exposure is suspected

FIRST-AID/THERAPY:

- artificial respiration and oxygen
- atropine-oxime therapy (especially 2 mg atropine + 150 mg obidoxime chloride in an autoinjector)
- supplemental administration of muscular relaxation medicines may be helpful
- immediate administration of appropriate therapy is essential
- prophylactic treatment with pralidoxime (2-PAM) is recommended if exposure is anticipated (e.g., in decontamination procedures)

- Neutralization/Decontamination: acetone: ammonia (1:1); addition of alkaline solution accelerates decomposition; also effective is a rise in temperature and addition of a catalyst (e.g., hypochlorite ions from bleaching powder)

AGENT: Sarin (GB) Isopropyl Methylphosphonofluoridate

PROPERTIES/CHARACTERISTICS:

- boiling point: 181°C
- volatility at 20°C: 15,000 mg/m^3
- colorless liquid with fruit-like odour
- miscible with water
- hydrolyzes rapidly in strong alkaline solution of pH 12 or higher
- inhibits acetylcholinesterase, thus disrupting nerve impulse transmission
- highly volatile and, therefore, relatively non-persistent

TOXICOLOGY/SYMPTOMATOLOGY:

- casualty dosage (unmasked): 35 $mg\text{-}min/m^3$
- lethal dosage: 100 $mg\text{-}min/m^3$
- chiefly and most rapidly absorbed through respiratory tract; not appreciably absorbed through skin or eyes
- onset of toxicity can occur within several minutes to few hrs depending upon concentration of Sarin; recovery takes at least 2 wks
- symptoms (concentration-dependent): at low concentration produces miosis; headache; increased salivation; increased nasal secretion; bronchoconstriction. At high concentration produces cough; greater difficulty in breathing; increased perspiration; GIT effects (nausea; vomition; colic; diarrhea); effects on skeletal musculature; death by suffocation due to effects on respiratory musculature and respiratory centre in central nervous system.

CAUTIONS:

- any Sarin not immediately vapourized can form a contact hazard on the ground which can subsequently reinforce the respiratory hazard
- increased lethality, especially through skin, at elevated environmental temperature
- Protection required: gas mask and protective clothing
- clothing should be decontaminated and skin washed thoroughly if Sarin exposure is suspected.

FIRST-AID/THERAPY:

- artificial respiration and oxygen
- atropine-oxime therapy (especially 2 mg atropine + 150 mg obidoxime chloride in an autoinjector)
- supplemental administration of muscular relaxation medicines may be helpful
- immediate administration of appropriate therapy is essential
- prophylactic treatment with pralidoxime (2-PAM) is recommended if exposure is anticipated (e.g., in decontamination procedures)
- Neutralization/Decontamination: addition of alkaline solution accelerates decomposition; also effective is a rise in temperature and addition of a catalyst (e.g., hypochlorite ions from bleaching powder); area exposed to Sarin will decontaminate itself within a few days

AGENT: Soman (GD) Pinacolyl Methylphosphonofluoridate

PROPERTIES/CHARACTERISTICS:

- boiling point 198°C
- volatility at 20°C: 2,700 mg/m^3
- relatively non-persistent; can be transformed into a persistent agent with the addition of a thickener
- sparingly soluble in water
- inhibits acetylcholinesterase, thus disrupting nerve impulse transmission
- odourless and colourless vapour

TOXICOLOGY/SYMPTOMATOLOGY:

- casualty dosage (unmasked): 35 $mg\text{-}min/m^3$
- lethal dosage: 50 $mg\text{-}min/m^3$
- symptoms (concentration-dependent): at low concentration produces miosis; headache; increased salivation; increased nasal secretion; bronchoconstriction. At high concentration produces cough; greater difficulty in breathing; increased perspiration; GIT effects (nausea; vomition; colic; diarrhea); effects on skeletal musculature; death by suffocation due to effects on respiratory musculature and respiratory centre in central nervous system

CAUTIONS:

- oxime-resistant nerve agent; acetylcholinesterase inhibited by Soman cannot be reactivated
- Protection required: gas mask and protective clothing
- clothing should be decontaminated and skin washed thoroughly if Soman exposure is suspected

FIRST-AID/THERAPY:

- artificial respiration and oxygen
- atropine therapy
- supportive treatment of symptoms
- supplemental administration of muscular relaxation medicines may be helpful
- immediate administration of appropriate therapy is essential

- Neutralization/Decontamination: acetone: ammonia 1:1; addition of alkaline solution accelerates decomposition; also effective is a rise in temperature and addition of a catalyst (e.g., hypochlorite ions from bleaching powder)

AGENT: VX Ethyl S-[2-diisopropylaminoethyl]-methylphosphonothioate

PROPERTIES/CHARACTERISTICS:

- boiling point: 300°C
- volatility at 20°C: 10 mg/m^3
- odour: like rotten fish (due to the amine function)
- solubility in water is between 1% and 5% at room temperature
- more resistant than Sarin due to hydrolysis, especially in alkaline solution
- inhibits acetylcholinesterase, thus disrupting nerve impulse transmission
- persistent; will remain on ground for several weeks (longer in cold climate)

TOXICOLOGY/SYMPTOMATOLOGY:

- casualty dosage (unmasked): 5 mg-min/m^3
- lethal dosage: 10 mg-min/m^3
- slightly slower onset of symptoms than Sarin
- primarily toxic by the dermal route
- symptoms (low dosages): miosis; headache; increased salivation; increased nasal secretion; bronchoconstriction; (high dosages); cough; increased perspiration; GIT effects: nausea; vomition; colic; diarrhea; effects on skeletal musculature; death by suffocation due to effects on respiratory musculature and respiratory centre in CNS
- it takes at least 2 wks to recover from sublethal dosage

CAUTIONS:

- long term contact hazard by contamination of ground, vegetation and equipment is possible
- hydrolysis products nearly as toxic as VX at pH 7
- Protection required: gas mask and protective clothing
- clothing should be decontaminated and skin washed thoroughly if VX exposure is suspected

FIRST-AID/THERAPY:

- artificial respiration and oxygen
- atropine-oxime therapy (especially 2 mg atropine + 150 mg obidoxime chloride in an autoinjector)
- supplemental administration of muscular relaxants may be helpful
- prophylactic treatment with pralidoxime (2-PAM) is recommended if exposure is anticipated (e.g., in decontamination procedures)
- Neutralization/Decontamination: (a) clothing, boots, gloves, etc., in the field - aqueous hypochlorite solution; (b) laboratory glassware or bulk decontamination: a solution of 10% sodium hydroxice in methanol

Comment:

It should be mentioned that certain insecticides and pesticides can induce effects similar to those of the nerve agents, though usually less severe. The investigating team should possess information concerning such substances. Such information has not been included in this document, for the sake of brevity. Standard reference texts exist which provide detailed information on industrial and agricultural chemicals.

Lethal/Toxin

WELL-KNOWN EXAMPLES:

Botulinal Toxin A
Staphylococcal Enterotoxin B
Ricin
Saxitoxin
Trichothecene Mycotoxins

GENERAL INFORMATION ON PROPERTIES/CHARACTERISTICS:

- poisons produced by living organisms (i.e., "natural toxins")
- most are relatively large, complex proteins, although the trichothecene mycotoxins are rather low molecular weight proteins
- sensitivity to heat varies
- possess very specific mechanisms of action
- significant concentrations of toxin may be found naturally in food and cereal grains

GENERAL INFORMATION ON TOXICOLOGY/SYMPTOMATOLOGY:

- range in toxicity from extremely toxic to merely incapacitating/harassing
- site of action varies: some are central nervous system toxicants while others affect the gastrointestinal tract circulatory immune and central nervous system
- cutaneous exposure may produce lesions
- effects apparent in some cases within ½ hr of exposure

CAUTIONS:

- avoid ingestion of contaminated food and/or water
- Protection required: gas mask and/or protective clothing

FIRST-AID/THERAPY:

- treat with appropriate anti-toxin
- provide supportive treatment of symptoms
- wash contaminated skin with soap and water

Specific examples follow

AGENT: Botulinal Toxins

PROPERTIES/CHARACTERISTICS:

- produced by Clostridium botulinum
- 900,000 dalton molecular weight protein (Toxin A)
- almost any food with a pH above 4.5 can, under suitable conditions, support growth of C. botulinum
- inhibits release of acetylcholine at neuromuscular junction

TOXICOLOGY/SYMPTOMATOLOGY:

- lethal dosage: 0.02 mg-min/m^3
- can cause poisoning following absorption through any mucous membrane, e.g., digestive tract or bronchial or conjunctival mucosa
- initial effects appear within 6-48 hrs; death after 3-8 days
- symptoms: dizziness; sore throat; dry mouth; progressive muscular weakness and paralysis (especially of musculature of eyes); death due to respiratory failure with associated cardiac arrest or complete vasomotor collapse

CAUTIONS:

- in cold, stagnant water botulinal toxin A is stable for a week
- in food, botulinal toxin A may persist a long time under anaerobic conditions
- all food and water should be heat sterilized before consumption
- protection required: gas mask and protective clothing if aerosol exposure is anticipated

FIRST-AID/THERAPY:

- treatment with appropriate anti-toxin significantly improves chances of survival
- as well, supportive treatment of symptoms should be administered
- toxoid immunoprophylaxis is feasible

- Neutralization/Decontamination: Botulinal toxin A is destroyed by boiling for 5-10 minutes. In addition, it is detoxified by formaldehyde and precipitated by specific anti-toxin

AGENT: Staphylococcal Enterotoxin B

PROPERTIES/CHARACTERISTICS:

- produced by Staphylococcus aureus
- 35,000 dalton molecular weight protein
- more stable than botulinal toxins
- heat resistant
- produces effects by direct irritant action on mucosa of the gastro-intestinal tract as well as by stimulation of vagal and sympathetic nerves (emesis)

TOXICOLOGY/SYMPTOMATOLOGY:

- casualty dosage (unmasked): < 1 mg-min/m^3
- generally not lethal but incapacitating
- initial effects begin within ½-6 hrs after ingestion of contaminated food
- symptoms: increased salivation; nausea; vomition; abdominal pain; watery diarrhea; prostration; pyrexia; hypotensive effects
- recovery usually occurs within 24 hrs
- death occurs only with excessive dehydration

CAUTIONS:

- Staphylococcal Enterotoxin B is not destroyed by boiling
- infants and debilitated persons are particularly susceptible to the dehydration effects of the poisoning
- Protection required: gas mask if aerosol exposure is anticipated; avoid consumption of contaminated food and/or water

FIRST-AID/THERAPY:

- therapy is essentially supportive treatment of symptoms
- toxoid can be prepared by formaldehyde treatment which shows immunizing capacity in rhesus monkeys

- Neutralization/Decontamination: none recognized

AGENT: Trichothecene Mycotoxins

PROPERTIES/CHARACTERISTICS:

- Normocyclic Trichothecenes: produced mainly by Fusarium spp.; more than 40 derivatives including nivalenol, deoxynivalenol (DON), diacetoxyscirpenol (DAS), T-2 toxin and HT-2 toxin
- Macrocyclic Trichothecenes: produced by Stachybotrys atra and other species; include Verrucarin, Roridin and Satratoxin
- low molecular weight proteins
- contain food refusal and emetic factors
- Trichothecene mycotoxins are stable for long periods of storage and are, therefore, highly persistent

TOXICOLOGY/SYMPTOMATOLOGY:

- lethal dosage (estimated LD_{50} for humans): 0.5 mg/kg
- possess skin irritation potential (especially with cutaneous exposure)
- cause radiomimetic (cytotoxic) injury of intestines, bone marrow, lymph nodes, spleen and thymus, resulting in leukopenia and bone marrow atrophy
- effects on CNS, circulatory system and reproduction
- Normocyclic Trichothecenes: Alimentary Toxic Aleukia (time course: 8 weeks with rapid onset of symptoms): burning sensation in alimentary tract; vomition; tachycardia; leukopenia; petechial hemorrhages with necrosis in skin; internal hemorrhages
- Macrocyclic Trichothecenes: Stachybotryotoxicosis: conjunctivitis; rhinitis; leukopenia; dermatitis; pulmonary fibrosis

CAUTIONS:

- avoid consumption of contaminated food and water
- grain stored improperly, especially under wet and cold conditions, may be severely infected by trichothecene-producing molds
- Macrocyclic trichothecene mycotoxins may be liberated upon burning contaminated grain or straw
- mixtures of naturally-occurring macrocyclic trichothecenes are highly potent and can produce death of animals within 24 hrs.
- Protection required: gas mask and protective clothing

FIRST-AID/THERAPY:

- wash contaminated skin with soap and water
- use active-absorbent compounds such as charcoal or bentonite to reduce absorption from the gut
- provide supportive therapy as required to improve cardiovascular function

Incapacitating/Psychochemicals

WELL-KNOWN EXAMPLES:

BZ (3-Quinuclidinyl Benzilate)
LSD [(+)-N,N-diethyllysergamide]

GENERAL INFORMATION ON PROPERTIES/CHARACTERISTICS:

- highly potent psychotropic drugs
- crystalline solids
- purely synthetic products
- stability to heat and light varies

GENERAL INFORMATION ON TOXICOLOGY/SYMPTOMATOLOGY:

- behavioural disturbances may be accompanied by physical incapacitation
- physical effects include blurred vision, fainting and vomition
- follow sequential pattern with somatic symptoms first, perceptual and mood changes next and finally psychic changes
- rapid onset of symptoms (appear 30-60 min. after exposure)
- effects last 12 hrs. to 2-4 days

CAUTIONS:

- due to the emotional and behavioural effects of these drugs, variable responses among individuals, and from situation to situation, may be experienced
- may be used as a water contaminant or to produce short term inhalation hazard
- protection required: gas mask

FIRST-AID/THERAPY:

- treat with appropriate antagonist: anticholinesterase drugs for BZ and depressants for LSD
- provide supportive therapy
- prevent person from injuring himself

Specific examples follow

AGENT: BZ (3-Quinuclidinyl Benzilate)

PROPERTIES/CHARACTERISTICS:

- anticholinergic psychomimetic drug
- mechanism of action similar to atropine
- white, crystalline solid
- phenylglycolate ester of an aminoalcohol
- possesses thermal stability
- intended primarily for use in aerosol form to create a respiratory hazard

TOXICOLOGY/SYMPTOMATOLOGY:

- casualty dosage (unmasked): 110 mg-min/m3
- symptoms: increased heart rate; dry skin and mouth; mydriasis and blurred vision; ataxia; disorientation; confusion progressing to stupor
- time course of effects (following inhalation exposure to large concentration): 1-4 hrs. - tachycardia; ataxia, dizziness; vomition; dry mouth; blurred vision; confusion and sedation leading to stupor; 4-12 hrs. - inability to respond to environmental stimuli or to move about; 12-96 hrs. - increased activity; random unpredictable behaviour; gradual return to normal 2-4 hrs. after exposure

CAUTIONS:

- inhibits sweating mechanism; if used in hot, dry climate, may induce severe heat stroke
- may be used as a water contaminant or to produce short term inhalation hazard
- protection required: gas mask

FIRST-AID/THERAPY:

- some of the effects can be countered by anticholinesterase drugs; an effective antagonist is physostigmine
- provide supportive therapy
- prevent person from injuring himself

AGENT: **LSD** **[(+)-N,N-diethyllysergamide]**

PROPERTIES/CHARACTERISTICS:

- melting point: 83°C
- chemically resembles serotonin; affects neurons having serotonin as neurotransmitter
- sensitive to heat and light
- crystalline free base formation (LSD 25) insoluble in water; tartrate readily soluble in water
- readily destroyed by oxidizing agents including chlorine in super-chlorinated water or bleaching powder

TOXICOLOGY/SYMPTOMATOLOGY:

- casualty dosage (unmasked): 10-100 mg-min/m^3
- highly active when administered orally or parenterally
- tolerance to LSD develops rapidly, but is usually lost in 2-3 days
- somatic symptoms include blurred vision; fainting; vomition; dilated pupils; hyper-reflexia; increased muscle tension; incoordination; ataxia; variable effects on pulse rate and blood pressure
- perceptual symptoms include altered shapes and colors; difficulty in focusing on objects; a sharpened sense of hearing
- psychic symptoms include alterations in mood; tension; distorted time sense; difficulty in expressing thoughts; depersonalization; dreamlike feelings; visual hallucinations
- symptoms first appear 30-60 mins. after exposure
- reach peak after 3-5 hrs. and last 12 hrs.

CAUTIONS:

- risk of severe reaction is increased by presence of cardiovascular disease, pregnancy or epilepsy
- residual effects may be apparent weeks or months after exposure
- may be used as a water contaminant or to produce a short-term inhalation hazard
- protection required: gas mask

FIRST-AID/THERAPY:

- some of the effects can be treated with depressants
- chloropromazine is an effective antagonist
- resperine is contraindicated
- provide supportive therapy
- prevent person from injuring himself

Harrassing/Lachrymator

WELL-KNOWN EXAMPLES:

Chloroacetaphenone	CN	$(C_6H_5COCH_2Cl)$
2-Chlorobenzalmalononitrile	CS	$(C_6H_4CHC(CN)_2Cl)$

GENERAL INFORMATION ON PROPERTIES/CHARACTERISTICS:

- solid, white substances
- distinctive odours
- thermally stable and non-volatile
- sparingly soluble in water; soluble in most organic solvents
- rate of hydrolysis varies from negligible to rapid
- sensory irritants affecting both eyes and respiratory tract

GENERAL INFORMATION ON TOXICOLOGY/SYMPTOMATOLOGY:

- threshold of action extremely low with low dosages producing characteristic effects
- effects occur almost instantaneously and disappear relatively quickly (15-30 min) after cessation of exposure
- effects include instant pain in eyes; lachrymation; burning sensation in mouth, throat and trachea; difficulty in breathing; vomition; burning of moist areas of skin
- rarely lethal
- serious lung damage (pulmonary edema) may occur if exposure to high dosages occur within an enclosed space

CAUTIONS:

- considerable individual variation in sensitivity to lachrymators affected by emotional state, motivation, physical activity, the surrounding temperature and humidity
- Protection required: gas mask with both charcoal filter and mechanical smoke filter

FIRST-AID/THERAPY:

- no real therapy necessary
- wash skin with warm sodium carbonate solution
- wash eyes with boric acid

Specific examples follow

AGENT: Chloroacetophenone (CN) $C_6H_5COCH_2Cl$

PROPERTIES/CHARACTERISTICS:

- melting point: 59°C boiling point: 247°C
- denser than air
- volatility at 20°C: 105 mg/m^3
- odour: in low concentrations, like apple blossoms
- only slightly soluble in water; soluble in organic solvents
- thermostabile

TOXICOLOGY/SYMPTOMATOLOGY:

- casualty dosage (unmasked): 80 $mg\text{-}min/m^3$
- lethal dosage : 11,000 $mg\text{-}min/m^3$
- symptoms appear almost instantaneously and remain until about 15-30 min after cessation of exposure
- symptoms (concentration-dependent): at low concentration produces pain in eyes; lachrymation. At high concentration produces burning irritation in mouth and upper respiratory tract; itching and burning of moist areas of skin; difficulty in breathing; vomition
- lung damage may occur with high dosages, especially in an enclosed space

CAUTIONS:

- not noticeably hydrolyzed in water
- Protection required: military type protective mask

FIRST-AID/THERAPY:

- wash eyes with boric acid
- wash skin with warm sodium carbonate solution

- Neutralization/Decontamination: hot sodium hydroxide solution

AGENT: 2-Chlorobenzalmalononitrile (CS) $C_6H_4CHC(CN)_2Cl$

PROPERTIES/CHARACTERISTICS:

- odour: faint peppery smell
- insoluble in water
- rapidly hydrolyzes
- decomposition accelerated by alkali
- thermostabile

TOXICOLOGY/SYMPTOMATOLOGY:

- casualty dosage (unmasked): 10 mg-min/m^3
- lethal dosage : 25,000 mg-min/m^3
- effects are more rapid and occur at lower concentrations than CN
- symptoms appear instantly and remain until about 15-30 min after cessation of exposure
- symptoms (concentration-dependent): at low concentration produces pain in eyes; lachrymation. At high concentration produces burning irritation in mouth and upper respiratory tract; itching and burning of moist areaas of skin; difficulty in breathing; vomition
- lung damage may occur with high dosages, especially in an enclosed space

CAUTIONS:

- untreated CS powder (CS1) under normal conditions in open terrain is effective for about 2 weeks; CS2 is even more persistent
- at particular risk are persons suffering from asthmatic disorders or chronic bronchitis
- persons experiencing previous CS-induced dermatitis may exhibit allergic response upon subsequent exposure
- Protection required: gas mask with both charcoal filter and mechanical smoke filter (CS does not react with charcoal)

FIRST-AID/THERAPY:

- wash eyes with boric acid
- wash skin with warm sodium carbonate solution

- Neutralization/Decontamination: strong hot sodium carbonate solution

Harassing/Sternutator

WELL-KNOWN EXAMPLES:

Adamsite DM (Diphenylaminechlorarsine)
Diphenylchlorarsine DA
Diphenylcyanarsine DC

GENERAL INFORMATION ON PROPERTIES/CHARACTERISTICS:

- solids with high melting points and negligible vapour pressures
- nonpersistent agents
- insoluble in water but soluble in organic solvents
- negligible hydrolysis or hydrolyzes with difficulty
- decompose when heated

GENERAL INFORMATION ON TOXICOLOGY/SYMPTOMATOLOGY:

- threshold of action extremely low with low dosages producing characteristic effects
- effects begin 2-3 min after exposure
- recovery complete in 1-2 hrs
- symptoms include intense sneezing; cough; headache; shortness of breath; nausea; vertigo; muscular weakness; temporary physical debility
- generally non-lethal in concentrations employed in the field

CAUTIONS:

- penetrate ordinary gas mask canister
- Protection required: gas mask fitted with the most efficient type of dust filter

FIRST-AID/THERAPY:

- breathe chlorine in low concentration

Specific examples follow

AGENT: Adamsite (DM) $(C_6H_4)_2NHAsCl$ Diphenylaminechlorarsine

PROPERTIES/CHARACTERISTICS:

- melting point: 195°C boiling point: 410°C
- denser than air
- volatility at 20°C: < 1 mg/m^3
- no pronounced odour
- insoluble in water
- hydrolyzes with difficulty
- readily decomposes when heated

TOXICOLOGY/SYMPTOMATOLOGY:

- casualty dosage (unmasked): 10 $mg\text{-}min/m^3$
- lethal dosage : 15,000 $mg\text{-}min/m^3$
- initial effects apparent 2-3 min after exposure begins and recovery is complete in 1-2 hrs
- effects: severe irritation to upper respiratory tract, peripheral sensory nerve endings and eyes
- symptoms: intense sneezing; cough; headache; shortness of breath; nausea; vertigo; muscular weakness; temporary physical debility
- at very high dosage, lungs may be damaged

CAUTIONS:

- since DM is odourless, one is not aware of breathing it until sufficient quantity has been absorbed to produce its typical physiological effects
- Protection required: military type protective mask

FIRST-AID/THERAPY:

- breathe low concentration of chlorine from bleaching powder bottle
- Neutralization/Decontamination: oxidation with hypochlorite, chloramine or potassium permanganate

AGENT: Diphenylchlorarsine (DA) $(C_6H_5)_2AsCl$

PROPERTIES/CHARACTERISTICS:

- melting point: 45°C boiling point: 383°C
- denser than air
- volatility at 20°C: 7 mg/m^3
- odour: like shoe polish
- insoluble in water but soluble in organic solvents
- slowly hydrolyzes
- decomposes upon boiling
- very difficult to achieve lethal concentration

TOXICOLOGY/SYMPTOMATOLOGY:

- casualty dosage (unmasked): 15 mg-min/m^3
- lethal dosage : 15,000 mg-min/m^3
- initial effects apparent 2-3 min after exposure and remain until 15 min after cessation of exposure; recovery is complete in 1-2 hrs
- if sufficient arsenic is absorbed, systemic arsenical poisoning may result
- effects: severe irritation to upper respiratory tract; peripheral sensory nerve endings and eyes
- symptoms: intense sneezing; cough; headache; shortness of breath; nausea; vertigo; muscular weakness; temporary physical debility

CAUTIONS:

- DA readily penetrates ordinary gas mask canister
- Protection required: military type protective mask

FIRST-AID/THERAPY:

- breathe chlorine in low concentration

- Neutralization/Decontamination: oxidation with hypochlorite, chloramine or potassium permanganate

AGENT: Diphenylcyanarsine (DC) $(C_6H_5)_2AsCN$

PROPERTIES/CHARACTERISTICS:

- melting point: 31.5°C boiling point: 350°C
- denser than air
- volatility at 20°C: 3 mg/m^3
- odour: like garlic and bitter almonds
- insoluble in water but soluble in organic fats and solvents (especially chloroform)
- negligible hydrolysis
- decomposes with boiling

TOXICOLOGY/SYMPTOMATOLOGY:

- casualty dosage (unmasked): 25 $mg\text{-}min/m^3$
- lethal dosage : 10,000 $mg\text{-}min/m^3$
- effects less intense and enduring than DA
- effects: severe irritation to upper respiratory tract, peripheral sensory nerve endings and eyes
- symptoms: intense sneezing; cough; headache; shortness of breath; nausea; vertigo; muscular weakness; temporary physical debility

CAUTIONS:

- DC penetrates ordinary gas mask canister
- Protection required: military type protective mask

FIRST-AID/THERAPY:

- breathe chlorine in low concentration

- Neutralization/Decontamination: caustic gaseous chlorine

Anti-Plant Agent/Herbicide

WELL-KNOWN EXAMPLES:

2,4-D	(2,4-Dichlorophenoxyacetic acid)
2,4,5-T	(2,4,5-Trichlorophenoxyacetic acid)
Picloram	(4-Amino-3,5,6-trichloropicolinic acid)
Cacodylic acid	(Dimethylarsinic acid)

N.B. These products have completely legitimate uses, and they should not normally be associated with chemical warfare agents.

GENERAL INFORMATION ON PROPERTIES/CHARACTERISTICS:

- function as plant growth regulators and desiccants
- applied directly to plants and trees to kill or defoliate them
- are employed in a non-military capacity in agriculture
- available in a variety of salt and ester formulations
- generally applied in admixtures of various herbicides (e.g., 2,4-D/2,4,5-T or 2,4-D/Picloram)

GENERAL INFORMATION ON TOXICOLOGY/SYMPTOMATOLOGY:

- only moderately toxic to warm-blooded animals
- lethal dose estimated in excess of five grams
- effects of chronic exposure are not completely delineated
- production methods may lead to formation of highly toxic contaminants (i.e., dioxins)
- symptoms: muscular weakness; peripheral neuritis; severe type of contact dermatitis (chloracne)

CAUTIONS:

- if used for hostile purposes, would probably be applied at concentrations much higher than those used commercially so that contamination of food and water supply is possible

FIRST-AID/THERAPY:

- treatment is essentially palliative and supportive

Anti-Plant Agent/Soil Sterilant

WELL-KNOWN EXAMPLES:

Bromacil (5-Bromo-3-sec-butyl-6-methyluracil)

Monuron (3-Lp-Chlorophenyl)-1,1-dimethylurea)

N.B. These products have completely legitimate uses, and they should not normally be associated with chemical warfare agents.

GENERAL INFORMATION ON PROPERTIES/CHARACTERISTICS:

- white crystalline solids with high melting points
- slightly to moderately soluble in water
- thermostable up to the melting point
- stable to oxidation and moisture
- applied either in dust formulations or in aqueous or fuel oil solutions
- used to contaminate soil and prevent or retard growth within it

GENERAL INFORMATION ON TOXICOLOGY/SYMPTOMATOLOGY:

- rather non-toxic by acute oral administration
- LD_{50} in excess of 3 g/kg in laboratory animals
- mildly irritating to abraded skin
- do not produce skin sensitization
- may observe depressed growth with prolonged exposure (in laboratory animals)

CAUTIONS:

- if used for hostile purposes, would probably be applied at concentrations much higher than those used commercially so that contamination of food and water supply is possible
- growth depressing effects may be of significant concern in terms of childhood exposure

FIRST-AID/THERAPY:

- treatment is palliative and supportive

9.1.2 Potential Biological Warfare Agents - Examples

Arboviruses:	Yellow Fever Tick-borne Encephalitis Japanese Encephalitis Venezuelan Equine Encephalitis Rift Valley Fever
Other Viral Infections:	Influenza Smallpox
Rickettsial Agents:	Epidemic Typhus Rocky Mountain Spotted Fever Q Fever
Bacterial Agents:	Plague Anthrax Tularaemia Brucellosis Typhoid Fever
Fungal Agent:	Coccidioidomycosis

Viral Agent: Yellow Fever

PROPERTIES/CHARACTERISTICS:

- Group B arbovirus
- transmitted mainly by mosquito (esp. *Aedes aegypti* and *Haemagogus* spp)
- natural cycle is monkey --> mosquito --> man
- infected mosquitoes require period of 9-12 days before they are capable of transmitting virus to man
- can be propagated in large quantities in eggs or tissue culture and freeze-dried
- aerosol transmission is possible
- monkey reservoirs in forest areas cannot be eradicated

SYMPTOMATOLOGY:

- incubation period: 3-6 days
- symptoms (sudden onset): fever; headache; backache; prostration; nausea; vomition; followed by epistaxis; bloody vomitus; jaundice
- case fatality rate: 30-40% (unvaccinated individuals)

TREATMENT/PROTECTION:

- supportive treatment
- mass vaccination with living attenuated vaccines
- vigorous and sustained anti-mosquito control measures

Viral Agent: Tick-borne Encephalitis

PROPERTIES/CHARACTERISTICS:

- two subtypes: Far Eastern and Central European/USSR
- transmitted by bites of infected ixodid ticks
- milk-borne transmission possible
- natural reservoirs in wild rodents, hedgehogs and birds
- can be grown in tissue culture
- quite stable in milk and milk products
- requires relatively high temperature for inactivation
- high infectivity by contact or by air-borne droplets
- ticks that transmit the disease are common in many areas

SYMPTOMATOLOGY:

- incubation period: 1-2 weeks
- symptoms: headache; respiratory symptoms; general malaise; progressing to severe headache; nausea; vomition; stiffness of neck; somnolence; delirium or coma; convulsions; partial or complete paralysis
- death occurs within one week
- in less severe cases, recovery can take up to one month with residual paralysis of arms and shoulder girdle possible
- case fatality rate: 20-30% (higher in children)

TREATMENT/PROTECTION:

- symptomatic treatment
- hospitalization required in severe cases
- available vaccines give only moderate protection

Viral Agent: Japanese encephalitis

PROPERTIES/CHARACTERISTICS:

- natural cycle involves culicine mosquitoes feeding on lower animals (pigs, birds, horses, bats)
- can be produced in tissue culture
- aerosol dissemination is feasible

SYMPTOMATOLOGY:

- symptoms: severe headache; very high fever; stiffness of neck; encephalitic signs (e.g., stupor; confusion and delirium; or somnolence progressing to coma)
- death occurs in about 10 days
- non-fatal cases may have a prolonged convalescence with weakness incoordination and partial paralysis
- serious sequelae including mental impairment and behavioural changes may occur in children under 10 and adults over 60 years of age
- case fatality rate: 20-30%

TREATMENT/PROTECTION:

- hospital care
- available vaccines confer some protection

Viral Agent: Venezuelan Equine Encephalitis

PROPERTIES/CHARACTERISTICS:

- transmission occurs through mosquitoes which have fed on infected animals (esp. rodents, birds, equines)
- infection can occur through contact or by inhalation of air-borne droplets
- can be produced in tissue culture
- most populations are completely susceptible

SYMPTOMATOLOGY:

- symptoms (sudden onset): severe headache; chills; fever; nausea; vomition; muscle and bone pains; encephalitis (occurs in 5% of cases)
- recovery is rapid after one week
- residual weakness may remain for up to three weeks
- case fatality rate: 0.5%

TREATMENT/PROTECTION:

- symptomatic treatment
- protection by vaccination is experimental

Viral Agent: Rift Valley Fever

PROPERTIES/CHARACTERISTICS:

- transmission through infected mosquitoes
- infection in man by inhalation or through handling infected animals
- virus stable in aerosols
- easily cultivated in chicken embryos and tissue culture
- wild animals (esp. rodents) may act as reservoirs

SYMPTOMATOLOGY:

- incubation period: 4-6 days
- in man, disease is very severe, but usually not fatal
- symptoms: sudden fever (lasting 2-3 days); malaise; nausea; vomition; severe headache; muscular pain; dizziness; followed by 1-2 day period of remission; another 2-3 days of fever
- recovery is uneventful
- malaise and weakness may persist
- rare ocular complications

TREATMENT/PROTECTION:

- symptomatic treatment

Viral Agent: Influenza

PROPERTIES/CHARACTERISTICS:

- air-borne infection
- grows easily in large quantities in embryonated chicken eggs
- can be dried or frozen for storage

SYMPTOMATOLOGY:

- incubation period: 1-3 days
- symptoms: fever; general malaise; respiratory distress; headache; myalgia; prostration
- symptoms may last for several days
- recovery complete in 1-2 weeks
- particularly susceptible are the very old and/or persons with pre-existing cardiovascular or respiratory difficulty
- case fatality rate: 0-2% (for current strains)

TREATMENT/PROTECTION:

- supportive treatment
- complications (e.g., pneumonia) be controlled with antibiotics
- vaccines are available against current strains
- 3-4 months would be required to prepare sufficient vaccine to protect population against a new strain

Viral Agent: Smallpox

PROPERTIES/CHARACTERISTICS:

- causative organism: Variola virus
- site of entry: upper respiratory tract or skin
- can be easily produced in large quantities in embryonated chicken eggs or tissue culture
- can be freeze-dried with virulence preserved for months or years

SYMPTOMATOLOGY:

- incubation period: 9-12 days
- symptoms: viremia characterized by fever, malaise, headache, backache, abdominal pain, prostration; rash subsequently develops
- rash: initially macular, quickly becomes papular, then vesicular and finally pustular
- sites of focal eruption are extremely rich in infective particles
- death occurs during pustular stage
- case fatality rate: 30%

TREATMENT/PROTECTION:

- supportive treatment
- isolation of infected persons is recommended
- small pox vaccine is highly effective and may give some protection if applied shortly after exposure
- chemoprophylaxis with methiazone has been successful

Biological Agents: Rickettsial

- Epidemic Typhus
- Rocky Mountain spotted fever
- Q fever

Specific descriptions follow

Rickettsial Agent: Epidemic Typhus

PROPERTIES/CHARACTERISTICS:

- causative organism: *Rickettsia prowazeki*
- transmitted from man to man by lice
- readily grown in embryonated chicken eggs
- aerosol infection can be produced

SYMPTOMATOLOGY:

- incubation period: 10-14 days (may be shortened with heavy exposure)
- symptoms (sudden onset): chills; aches and pains; headache; weakness; fever (remains until recovery or death); rash (appears during first week)
- symptoms grow progressively worse with critical period during second and third weeks
- case fatality rate: increases with age (i.e., 3% in infants, 30% in 40-50 age group and 50% in old persons)

TREATMENT/PROTECTION:

- treatment with antibiotics is recommended
- prophylactic vaccination is effective

Rickettsial Agent: Rocky Mountain spotted fever

PROPERTIES/CHARACTERISTICS:

- causative organism: *Rickettsia rickettsi*
- transmitted by ixodid ticks from infected field mice, rabbits, hares, squirrels, chipmunks and dogs
- can be cultured in large quantities in embryonated chicken eggs
- aerosol infection is possible

SYMPTOMATOLOGY:

- incubation period: 3-12 days
- symptoms (sudden onset): severe headache; chills; fever; muscle and joint pain; prostration; rash (begins on about fourth day)
- symptoms continue for 2-3 weeks
- death due to toxemia, shock, blood vessel alterations and renal failure
- case fatality rate: 3-7%

TREATMENT/PROTECTION:

- antibiotic therapy
- intensive medical care
- vaccinal prophylaxis gives varying degrees of protection

Rickettsial Agent: Q fever

PROPERTIES/CHARACTERISTICS:

- causative agent: *Coxiella burneti*
- natural reservoirs include all kinds of domesticated livestock and poultry, hogs, rodents, baboons and wild birds as well as 40 different species of ixodid and argasid ticks, mites and parasitic flies
- transmission primarily by air-borne route via inhaled droplets or dust and by ingestion of insufficiently heated milk or milk products
- relatively resistent to environmental influences (e.g., temperature changes and humidity)
- extremely infectious to man
- readily produced in large quantities in embryonated chicken eggs

SYMPTOMATOLOGY:

- incubation period: 18-21 days (may fall to 10 days with exposure to large doses)
- symptoms (sudden onset): chills; fever; headache; loss of appetite; muscle and chest pains; general malaise; progression to stiffness of neck and back; confusion and disorientation; pneumonia
- weakness and fatigue may last for months, accompanied by weight loss
- fever may persist for a month or more in persons over 40 years
- case fatality rate: less than 1% (may be higher in Africans)

TREATMENT/PROTECTION:

- antibiotics are effective if given early and can prevent symptoms if given late in incubation period
- prophylactic vaccines are not very successful
- since food products can be contaminated, they should be thoroughly cooked before consumption

Biological Agents: Bacterial

- Plague
- Anthrax
- Tularaemia
- Brucellosis
- Typhoid fever

Specific descriptions follow

Bacterial Agents: Plague

PROPERTIES/CHARACTERISTICS:

- causative organism: Pasteurella pestis
- transmitted to man by fleas from infected rodents (bubonic plague) or directly from man to man (pneumonic plague)
- resistent to environmental conditions (i.e., survive a wide range of temperatures, -2° to +45°C)
- freeze-drying can preserve virulence for long periods of time
- can be easily prepared in large quantities
- aerosols containing 1-5 u droplets are capable of producing pneumonic plague

SYMPTOMATOLOGY:

- incubation period: 2-6 days (bubonic plague); 3-4 days (pneumonic plague)
- symptoms: bubonic plague - high fever; shock; mental confusion; acute and painful swelling of lymph nodes draining site of entry of microorganisms; prostration; delirium; coma
  pneumonic plague - primary pneumonia
- case fatality rate: 25-50% (bubonic plague); almost always fatal (pneumonic plague)

TREATMENT/PROTECTION:

- antibiotics are effective if administered early in the disease
- vaccinal prophylaxis is moderately effective against bubonic plague, but not against pneumonic plague
- protection is relatively short-lived (3-12 months)
- massive infection can overcome vaccine-conferred immunity

Bacterial Agent: Anthrax

PROPERTIES/CHARACTERISTICS:

- causative organism: Bacillus anthracis
- produces highly resistent spores that persist in environment for decades
- infection possible by contact with animals or contaminated animal products or by inhalation of infected dust from hides, wool and similar substances
- aerosol dispersion is possible
- can readily be produced in large quantities
- virulent antibiotic-resistent strains have been produced

SYMPTOMATOLOGY:

- incubation period: a few days to 1-2 weeks (dependent upon magnitude of exposure)
- symptoms: dermal exposure - malignant pustule formation progressing to septicemia
  inhalation exposure - toxemia and septicemia
- case fatality rate: 20% (dermal); greater than 80% (inhalation, oral)

TREATMENT/PROTECTION:

- antibiotics are moderately effective if disease is recognized early and treatment is prolonged (death can occur if antibiotic therapy is discontinued too early)
- vaccines can confer good protection in small exposures, but their value is not known in heavy exposures
- food contamination would require prolonged sterilization to make all animal and food products safe

Bacterial Agent: Tularaemia

PROPERTIES/CHARACTERISTICS:

- causative organism: Pasteurella tularensis
- transmitted by arthropods (different species of ticks, fleas and flies)
- infection produced through contact with infected animals (wild mammals and birds) or arthropods, through ingestion of contaminated food and water or through inhalation of contaminated dust
- easily transmitted by aerosol
- highly infective in man
- resists environmental influences
- easily produced in large quantities and can be stored for years in dried form
- virulent and antibiotic-resistent strains available

SYMPTOMATOLOGY:

- incubation period: 1-10 days (average: 3 days); length of time varies with route of exposure (dermal being longest and oral or inhalation shortest)
- symptoms: dermal exposure - swelling of lymph glands draining area; malaise; fever
  oral exposure - symptoms resemble typhoid fever
  inhalation exposure - pneumonia
- septicemia causes necrotic lesions in many organs
- illness lasts several weeks and relapses could occur over a period of months
- case fatality rate: 25%

TREATMENT/PROTECTION:

- streptomycin is highly effective against non-resistent strains
- other antibiotics (tetracyclines, chloramphenicol) are effective, but treatment must be prolonged (about 10 days) to prevent relapses
- prophylactic vaccination only marginally modifies the effects of exposure to concentrated aerosol
- contaminated food and water should be heat sterilized prior to consumption

Bacterial Agent: Brucellosis

PROPERTIES/CHARACTERISTICS:

- causative organisms: Brucella abortus, suis or melitensis
- infection readily occurs through contact (small abrasions in the skin or mucosa), ingestion or inhalation
- readily produced in large quantities
- persistent in environment for weeks, while in dried form retains virulence for years
- highly infective to man
- B. suis and melitensis produce most severe disease in man

SYMPTOMATOLOGY:

- incubation period: 1-4 weeks (dependent upon magnitude of exposure)
- acute and chronic infection possible
- symptoms: chills; undulating fever; headache; loss of appetite; mental depression; extreme exhaustion; aching joints; sweating
- symptoms last for 2-4 weeks, but may continue for months
- relapses may occur for months or years and result in invalidism accompanied by liver and bone complications
- case fatality rate: less than 2% (children more resistent to low exposures)

TREATMENT/PROTECTION:

- antibiotic treatment for prolonged periods is only moderately effective
- vaccines protect to only a limited extent
- contaminated food and water should be heat sterilized prior to consumption

Bacterial Agent: Typhoid Fever

PROPERTIES/CHARACTERISTICS:

- causative organism: *Salmonella typhi*
- infection usually occurs through gastrointestinal tract although aerosol infection can be produced
- can be prepared in large quantities
- withstands normal environmental conditions
- contamination of water supply possible

SYMPTOMATOLOGY:

- incubation period: 1-2 weeks
- symptoms (gradual onset): malaise; headache; fever; progressing to prostration; abdominal distress; rash; high fever
- 3-5% of infected people remain carriers and sources of infection for long period
- case fatality rate: 10% (without treatment); less than 1% (with treatment)

TREATMENT/PROTECTION:

- chloramphenicol treatment
- hospitalization and isolation for 2-3 weeks
- chemoprophylaxis and immunoprophylaxis are not effective against very large doses of organism
- contaminated food and water should be heat sterilized prior to consumption

Biological Agents: Fungal

- Coccidioidomycosis

Specific description follows

Fungal Agent: Coccidioidomycosis

PROPERTIES/CHARACTERISTICS:

- causative organism: *Coccidioides immitis*
- dust-borne disease
- infection occurs through inhalation of infective arthrospores
- aerosol dispersion feasible
- arthrosporic form is resistent to environmental influences
- readily grown in large quantities
- subclinical infections are common

SYMPTOMATOLOGY:

- incubation period: 10-20 days
- symptoms: influenza-like illness with fever, chills, cough, pleural pain, headache, backache
- 20% develop erythema nodosum
- lung lesions (fibrosis and calcification) possible
- in rare cases, development of abscesses and involvement of bones and central nervous system
- case fatality rate: 50% (untreated)

TREATMENT/PROTECTION:

- lack of effective methods of prophylaxis and chemotherapy
- amphotericin B may be effective, but it is relatively toxic and relapses may occur when treatment is discontinued

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   Vol. II: CB Weapons Today. Almqvist and Wiksell, Stockholm, 1973.

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9.2 ILLUSTRATIVE QUESTIONNAIRE

ILLUSTRATIVE QUESTIONNAIRE:

ALLEGED USE OF CHEMICAL OR BIOLOGICAL WEAPONS

Part 1: Administrative

1. Interview number _ _ _ _

2. Date

yr. mo. day

3. Specify languages used in interview _____

4. Interviewer's Name _____

5. Occupation (if in the military, specify and give rank)

_____

6. Interpreter's Name _____

7. Interpreter's Occupation: (Check one)

Local government officer 1
Military member 2
Missionary 3
Other _____ 4
(specify)

8. Is he/she a qualified translator?

Yes 1
No 2

9. Is he/she formally trained in the language used in the interview?

Yes 1
No 2

10. How many years of schooling does the interpreter have?

Years of Schooling: _ _

Part 2: Background and Personal History of Respondent

1. Respondent's Name: _____

2. Current place of residence: _____

3. Sex:

   Male 1
   Female 2

4. Age at last birthday (if unknown, estimate) __ __

5. Nationality _____

6. To which major tribal, linguistic or ethnic group do you belong, if any? _____

7. What languages do you speak? _____

8. What language do you speak with your family members? _____

9. Which statement best describes your current status?

   Foreign member of an international relief agency (specify) _____ 1

   An international observer (specify) _____ 2

   A member of a foreign Embassy 3

   A Government Official of the country hosting refugees (specify)_____ 4

   A Refugee or Displaced Person 5

   A person living in the area of an alleged attack but not displaced 6

   Other (specify) _____ 7

10. What is or was your occupation? _____

11. In the past 5 years have you ever served in or with any military organization (including Regular Armed Forces, citizens army, reserves)?

Yes 1
No ..... 2 (go to Question 14)

12. If yes, please specify whether a member of:

A National Armed Forces 1
Another type of armed force 2

13. Were you a:

Senior leader of troops 1
Junior leader of troops 2
Not a leader of troops 3

14. Are you currently a civilian or a member of an armed forces?

Civilian ..... 1 (go to Question 16)
Armed Forces member 2

15. If a military member, what is your rank? _____

16. How many years of schooling have you completed?

Years of schooling __ __

17. If the individual's answer to Part 2, Q. 9 was either 1, 2 or 3, he is defined as an "independent observer"; and if his answer was either 4, 5, or 6, he is defined as an indigenous person for the purposes of this question. Select one of the following statements that best describes him.

An expert witness who has either directly or indirectly been involved in testing for the agent 1

An independent observer present at the site during an attack 2

An independent observer present at the site after an attack 3

An independent observer who interviewed people who were present at the site during an attack 4

An independent observer who interviewed people who heard of an attack but were not themselves present at the time of the attack 5

An indigenous person present at the site during an attack 6

An indigenous person present at the site after an attack 7

An indigenous person who talked or interviewed people who were present at the site during an attack 8

An indigenous person who talked to or interviewed people who heard of an attack but were not themselves present at the time of an attack 9

Part 3: Previous State of Health

INSTRUCTIONS

This section is to be completed by individuals:

(1) Who were at the site during an attack.

(2) Who were at the site within 72 hours after the attack.

(3) Who are not independent observers but who are providing testimony.

(4) Who are to be included in the control group of any epidemiological study.

Independent observers who were present at a site 4 or more days after an attack are to go to Part 4, entitled "Events of Alleged CBW Attack".

Expert witness are to go to Part 6, entitled "Expert Information".

1. What is your current marital status?

Married	1
Separated	2
Divorced	3
Widow/Widower	4
Remarried	5
Never Married	6

2. How many children do you have? (If none, write '00') __ __

3. Has any member of your family died within the last 12 months?

Yes	1	(specify relationship) _____
No	2	

4. Are you currently separated or living apart from members of your family?

Yes	1
No	2

5. Are you currently living alone?

   Yes 1
   No 2

6. Where are you currently residing?

   home/natal village or town 1
   village or town not considered as home 2
   hospital 3
   refugee camp 4
   other (specify) _____ 5

7. What village/town/city do you come from? _____

8. How many times have you changed residence (i.e. moved geographically) in the past 12 months? (If none, write '00').

   No. of moves: __ __

9. How many months have you been away from your "home village/town"?

   No. of months: __ __

10. In the past 12 months have you lost all or most of your worldly possessions?

    Yes 1
    No 2

11. Are you currently working?

    Yes 1
    No 2

12. What type of work are you currently doing? (specify) _____

13. Are you currently receiving any type of assistance from any international agency or government?

    Yes 1
    No 2

    If yes, specify _____

14. Which one statement best describes the respondent's current situation in the village? If the respondent is currently displaced or living away from home, which statement best describes his situation in his "home village"? (Probe for answer)

A large land-owning family of influence	01
A land-owning family	02
A tenant working family	03
A business-owning family of influence	04
A small business-owning family	05
A paid labourer or worker	06
A senior government official	07
A minor government official	08
A professional (e.g. teacher, health worker, etc.)	09
Other (specify) _____	10

INSTRUCTIONS

> Individuals who are providing testimony on an attack but were not present at the site of an attack are to go to Part 4 entitled "Events of Alleged CBW Attack".

15. In the past 12 months have you taken:

	Yes	No
opium	1	2
marijuana	1	2
hashish	1	2

> If "No" to all of these go to Question 20.

16. Thinking back over the 14 days before the attack, did you take opium?

Yes	1
No	2

17. Thinking back over the 14 days before the attack did you take marijuana/hashish?

Yes	1
No	2

18. Did you take marijuana or hashish after the attack?

Yes	1
No	2

19. Did you take opium after the attack?

Yes	1
No	2

20. In the 14 days before the attack did you see or talk to any of the following people about your health or the way you were feeling?

	Yes	No
medical doctor	1	2
indigenous health practitioner	1	2
medical nurse	1	2
Other (specify) _____	1	2

21. Before the attack, how would you describe your physical condition (health) compared to other persons of your age? Would you say your physical condition was:

excellent	1
good	2
fair	3
poor	4

The interviewer is to read the following instructions to the respondent.

We should like to know if you have had any medical complaints and how your physical condition (health) has been in general. Remember that we want to know about your past complaints before the attack, not those that you have had recently.

22. In the year before the alleged attack were you ever ill?

Yes	1
No	2
Uncertain	9

23. In the past year, how many times did you go to a medical practitioner (including western medical trained doctors and indigenous practitioners) for treatment?

Number of times: ___ ___ (use 00 for never)

24. What illness(es) were you treated for? About how long ago was this?

INSTRUCTIONS

Record the name of the illness (including the indigenous word plus its translation) and a brief description of the symptoms.

Illness	Time (No. of months since treatment began)
_____	_____
_____	_____

25. If treated in the past, specify the name of the doctor and/or his whereabouts (i.e. address). _____

26. In the past, were you ever treated by a medical doctor for:

	Yes	No
Ear disease	1	2
Eye disease	1	2
Nose or throat disease	1	2
Chest disease	1	2
Stomach (digestive tract) disease	1	2
Urinary tract disease	1	2
Skin disease	1	2
Fever	1	2

27. If "Yes" to any of the above, probe the nature of the disease and give details of the disease including approximate number of years ago the respondent had the disease.

Disease	No. of years since treatment began
_____	_____
_____	_____

28. We would like to ask you some more questions about your past complaints, not those that you have had recently. Have you had the following for several weeks or longer:

	Yes	No
Skin sores which would not heal	1	2
A skin rash	1	2
Itchy skin	1	2
A fever	1	2
Dizziness	1	2
Any blood in your stools	1	2
Loose stools	1	2
Pain in your abdomen	1	2
Recurrent vomiting	1	2
Blood in your vomit	1	2
Recurrent pains in your stomach/abdomen	1	2
Recurrent discomfort or pains in the chest	1	2
Difficulty breathing when lying down	1	2
Your chest (heart) sometimes beat very fast even when you were not exerting yourself	1	2
Continuous cough	1	2
Coughed up blood	1	2
Coughed up a greenish slime	1	2
Coughed or took a deep breath that gave you a pain in the chest	1	2
Sudden attacks of coughing	1	2
Woken up at night because of a cough and shortness of breath	1	2
Headaches	1	2
Pains in your eyes	1	2
Yellowness in the whites of the eyes	1	2
Blurred or double vision	1	2
Sores in the corners of your mouth	1	2
White, tender patches in your mouth	1	2
Nose bleeds	1	2
Neck pains	1	2
Pain in one or both legs	1	2
Stiff joints	1	2
Swollen or painful joints	1	2
Difficulty sleeping	1	2
Loss of appetite	1	2

Part 4: Events of Alleged CBW Attack

1. Were you present at the site at the time of an attack?

   Yes ..... 1 (go to Question 4)
   No 2

2. How long after the attack was it before you visited the site?

   same day 00
   next day 01
   2 days after 02
   3 days after 03
   4 days after 04
   5 days after 05
   6 days after 06
   7 days after 07
   8-14 days after 08
   15-21 days after 09
   22-28 days after 10
   29 or more days after 11
   never at site of attack .. 12

INSTRUCTIONS

> Question 3 to be completed by independent observers or indigenous individuals who talked to or interviewed people present at the site of an attack.

3. a) Do you know the names of the people you interviewed or talked to at the site of the attack?

   Yes ..... 1 (specify names below)
   No ..... 2 (go to Question 4)

   b) Do you know where these people can be located?

   Yes ..... 1 (specify)
   No 2

Name	Present Location/Address
_____	_____
_____	_____

4. a) Have you been present during an attack on more than one occasion?

Yes 1
No 2
Not applicable ..... 9 (go to Question 5)

b) If yes, specify the locations and dates of the attack. (List the most recent attacks first)

Location	Date
_____	_____
_____	_____

5. Where did the attack under review occur? _____

6. Approximately how many people lived in the village/town then?

— — —

7. What was the date and time of the attack?

Date:
Yr. Mo. Day

Time of day _____

8. Did the attack occur at sunrise or sunset?

Yes 1
No 2

9. Using you own words, can you please describe what happened. (Do not prompt the respondent.)

INSTRUCTIONS

Please record as precisely as possible the respondent's account. Pay specific attention to: the description of any strange substance, the type of delivery system, the type of shelter the respondent was in, contact made with the substance, description and onset of symptoms. Do not prompt the respondent; simply ask if there was anything else that he can recall.

10. I would like to ask you a few questions about people who became ill or died in nearby villages after the attack. First, I would like you to help me draw a picture/map of the area. What are the names of the surrounding villages? How far away are they from the site of the attack.

INSTRUCTIONS

Place numbers on the map and write the name of the village and the distance from the site of the attack (indicated by 'x' on the map) below. Specify villages up to 15 km away.

Village No.	Name of Village	Distance

11. On the day your village was attacked, were any of the surrounding villages directly attacked in the same way?

Yes ..... 1 (If yes, specify corresponding village No. _____)
No 2
Uncertain 9

12. For each of the villages you named in Question 10, can you tell me the number of people who died or were ill after the attack? (If respondent is "uncertain" or "does not remember", specify which of these categories applies by writing the appropriate word next to the village name.)

Village No.	Ill	Died

Now, I'd like to ask you some more questions about the attack.

13. Do you recall what the weather was like at the time of the attack?

Yes 1
No 2
Not Applicable .... 9 (go to Question 15)

14. If "Yes", what was the weather like at the time of the attack?

Bright, sunny 1
Cloudy 2
Rainy 3
Hazy 4
Other (specify) _____ 5

15. Do you recall whether there was a wind at the time of the attack?

INSTRUCTIONS

> The respondent may not think of "wind" as a "gentle breeze"; therefore it may be useful to ask if the leaves were moving at the time of the attack and in what direction they moved. If the respondent is a local villager, it may be useful to inquire about the general direction the wind moves for the time of day and season when the attack took place.

Yes 1
No 2

16. What direction was the wind blowing at the time of the attack? (PROBE)

Direction of wind was: _____

17. What were you doing at the time of the attack?

Working 1
Walking 2
Sitting 3
Playing 4
Not applicable (not present) 9

18. Where were you at the time of the attack?

Outside 1
In a motor vehicle 2
In an open shelter 3
In an enclosed shelter 4
Other (specify) _____ 5
Not applicable (not present) ... 9

19. What method was used to deliver the attack? In the boxes below, record the number corresponding to the weapon used in the attack.

		Weapons	
First weapon	☐	Aircraft - bomb	1
		Aircraft - spray	2
Second weapon	☐	Rockets	3
		Artillery	4
Third weapon	☐	Mortar	5
		Other (specify) _____ ..	6
		Uncertain	9

20. How far away were you from the actual site of detonation or spraying? (Estimate the distance by pointing to an object and asking the respondent if that is how far he was from the site of detonation or spraying.)

Distance: _____ meters
Uncertain or don't remember 1
Not applicable (Not present) 9

21. From where you were situated, in what direction was the site of detonation or spraying?

Direction: _____
Not certain 1
Not applicable (Not present) 9

INSTRUCTIONS

If an aircraft was involved in the attack, continue with Question 22; otherwise, go to Question 29.

22. Did you see the aircraft?

Yes 1
No 2

23. Do you know in general what type of aircraft it was?

Do not know/Uncertain 1
Fixed wing 2
Helicopter 3
Jet 4
Propeller 5

INSTRUCTIONS

If the respondent knows the general type of aircraft used in the attack, then show the respondent actual photographs of different types of aircraft and ask Question 24.

24. Can you identify the aircraft used in the attack from these photographs?

Don't know/uncertain 1
Type(s) of aircraft identified _____

25. Do you know how many aircraft were involved in the attack? (Write the number of aircraft in the spaces provided. If uncertain or don't know, write 99.)

Number ___ ___

26. Before the aircraft attacked, did you see it drop a flag, a streamer or some form of material?

Uncertain, don't recall seeing any marker dropped 1
No form of marker was dropped 2
A marker was dropped 3

27. How many times did the aircraft attack?

One 1
Two 2
Three 3
Four 4
Five 5
Six or more times 6
Uncertain 7
Don't know (not seen) 9

28. What did the aircraft drop or fire?

bombs 1
rockets 2
some form of spray 3
drums, bags or containers 4
Don't know/uncertain 9

29. Did you see the (bombs/shells/rockets) explode?

Yes 1
No ..... 2 (go to Question 31)

30. If yes, did the (bombs/rockets/shells) explode when they hit the ground, or did they explode in the air?

Ground burst 1
Air burst 2
Some on ground and some in air .. 3
Uncertain 9

31. Did the (bombs/rockets/shells) that exploded produce any clouds?

Yes 1
No 2
Uncertain 9

32. What colour was the cloud/spray? _____

INSTRUCTIONS

Use colour chart to identify and record colour of the cloud/spray.

33. Did the cloud/spray have an odor?

Yes ..... 1 (If yes, describe the odor _____)
_____
No 2
Uncertain 9

34. What did the (cloud/spray) look like? (Answer each)

	Yes	No
Powder or dust like	1	2
Like rain/droplets	1	2

35. Did any of the (cloud/spray) fall on you or did you touch any of the substance?

Yes 1
No 2

36. How did the substance feel when it touched your skin? (Answer each)

	Yes	No
Sticky	1	2
Hot/burning	1	2
Cool	1	2
Wet	1	2
Dry	1	2
Itchy	1	2
Hurt (non-specific)	1	2

37. At the time of the attack, did you do anything to protect yourself?

Yes ..... 1 (If yes, specify _____)
No 2
Not present 9

38. Did you personally have any pain or suffering during the attack?

Yes 1
No 2
Not present 9

39. What were the symptoms of the pain or suffering brought on by the attack? (Answer each item)

INSTRUCTIONS

Record the symptoms regardless of whether the symptoms were personally experienced by the respondent or inferred from reports.

For each symptom, ask the respondent when he first noticed the symptom. Then, in the space beside each symptom under the heading Onset, record one of the following numbers: '1' symptom noticed immediately; '2' symptom noticed later in the day; '3' symptom noticed next day; '4' symptom noticed 2 days later; '5' symptom noticed 3 or more days later; '9' don't remember or uncertain.

After inquiring about the onset of each symptom, ask the respondent how long the symptom lasted. Under the heading Duration, record the actual number of days the symptom lasted. If the symptom lasted for hours or for the day only, write '0'; and if the symptom lasted for 8 or more days but is no longer experienced, write '8'; if the symptom is still persisting, write '9'.

Item Number		Yes	No	Onset	Duration
01	Were the eyes affected? (If "No", go to No. 10)	1	2		
02	Eye pain	1	2		
03	Redness in eyes	1	2		
04	Swelling of eyes/eye lids	1	2		
05	Double vision	1	2		
06	Tearing of eyes	1	2		
07	Whites of eyes turned yellow	1	2		
08	Burning eyes	1	2		
09	Temporarily blinded	1	2		
10	Was the nose affected? (If "No", go to No. 22)	1	2		
11	Swelling nose	1	2		
12	Itching nose	1	2		
13	Burning nose	1	2		
14	Dryness of nose	1	2		
15	Bleeding nose	1	2		
16	Pain in nose (non-specific)	1	2		
17	Increased nasal secretions	1	2		
18	Clear discharge	1	2		
19	Yellow discharge	1	2		
20	Red discharge	1	2		
21	Other (specify) _____	1	2		
22	Was the mouth and/or throat affected? (if "No", go to No. 35)	1	2		
23	Dry throat/mouth	1	2		
24	Taste left in mouth (specify)_____	1	2		
25	Soreness of throat	1	2		
26	Tightness of throat	1	2		
27	Burning of throat	1	2		
28	Hoarseness of throat	1	2		
29	Swollen lips	1	2		
30	Mouth ulcers	1	2		
31	Blisters around mouth	1	2		
32	Bleeding from mouth	1	2		
33	Swollen tongue	1	2		
34	Other (specify) _____	1	2		
35	Were the ears affected? (If "No", go to No. 39)	1	2		
36	Pain in ears (non-specific)	1	2		
37	Blistering of ears	1	2		
38	Loss of hearing	1	2		
39	Was the neck affected? (If "No", go to No. 42)	1	2		
40	Stiff neck	1	2		
41	Swelling of neck	1	2		

Item Number		Yes	No	Onset	Duration
42	Was the chest or breathing affected? (If "No", go to No. 58)	1	2	___	___
43	Difficulty breathing	1	2	___	___
44	Tightness of chest	1	2	___	___
45	Shortness of breath	1	2	___	___
46	Wheezing	1	2	___	___
47	Chest pains	1	2	___	___
48	Burning sensation in chest	1	2	___	___
49	Choking feeling	1	2	___	___
50	Dry cough	1	2	___	___
51	Secretions increased during coughing	1	2	___	___
52	Sputum was clear	1	2	___	___
53	Sputum was white	1	2	___	___
54	Sputum was yellow	1	2	___	___
55	Sputum was green	1	2	___	___
56	Blood in sputum	1	2	___	___
57	Other (specify) _____	1	2	___	___
58	Was the skin affected? (If "No", go to No. 67)	1	2	___	___
59	Itching	1	2	___	___
60	Burning sensation	1	2	___	___
61	Blistering	1	2	___	___
62	Rash	1	2	___	___
63	Skin was burnt	1	2	___	___
64	Skin discoloured - red	1	2	___	___
65	Skin discoloured - yellow	1	2	___	___
66	Skin discoloured - black	1	2	___	___
67	Were there stomach/abdominal pains?	1	2	___	___
68	Swelling of abdomen	1	2	___	___
69	Nausea	1	2	___	___
70	Vomiting	1	2	___	___
71	Blood in vomit	1	2	___	___
72	Diarrhoea	1	2	___	___
73	Blood in diarrhoea	1	2	___	___
74	Bleeding from rectum	1	2	___	___
75	Painful urinating	1	2	___	___
76	Was there swelling of the joints?	1	2	___	___
77	Were there pains of the joints?	1	2	___	___
78	Were there muscle tremors (fasiculation)?	1	2	___	___
79	Generalized body tension	1	2	___	___
80	Loss of appetite	1	2	___	___
81	Fever	1	2	___	___
82	Sweating	1	2	___	___
83	Dizziness	1	2	___	___
84	Headaches	1	2	___	___
85	Unconsciousness	1	2	___	___

Item Number		Yes	No	Onset	Duration
86	Drunk-like - Difficulty walking	1	2		
87	Disoriented	1	2	___	___
88	Convulsions	1	2	___	___
89	Drowsiness	1	2	___	___
90	Insomnia - difficulty sleeping	1	2	___	___
91	Other (specify) _____	1	2	___	___

40. Did you receive any help or medical treatment?

Yes 1
No 2
Not Applicable .. 9] (go to Question 44)

41. How many days after the attack was it before you received medical treatment?

_____ days

42. Where did you receive medical treatment?

Place: _____

43. What treatment did you receive? (record both "western" and "indigenous" treatments.)

Treatment: _____

_____

44. Are you still suffering from the effects of this attack?

Yes 1
No 2
Not Applicable 9

INSTRUCTIONS

The following statement is to be read to the respondent: I would like to ask you a few questions about the place where the attack took place.

45. In the village, where the attack took place, where do you usually get your water?

Tube well	1
Covered well or storage tank	2
Open well or storage tank	3
Stream/pond	4
Not applicable/don't know	9

46. Did you drink any of this water after the attack?

Yes	1	
No	2	(go to Question 49)
Not applicable	9	(go to Question 49)

47. When you drank this water, how many days after the attack was it?

Same day	0
One day after	1
Two days after	2
Three days after	3
Four days after	4
Five days after	5
Six days after	6
Seven days after	7
Eight or more days after	8
Uncertain	9

48. What happened after you drank the water?

INSTRUCTIONS

Record the Item Number of the symptoms(s) and the time of Onset as specified in the instruction to Question 39. If no effects were noted, write '90'; if uncertain, write '99' then continue.

Symptoms	Onset
_____	_____
_____	_____
_____	_____
_____	_____

49. Did the water at the site of the attack have a strange unusual colour?

Yes 1
No 2
Uncertain ..... 9 (go to Question 51)

50. If yes, what colour was the water? (Use the colour chart).

Colour: _____

51. Did the water have a strange/unusual odor?

Yes 1
No 2
Uncertain ..... 9 (go to Question 53)

52. If yes, what did it smell like?

Odor: _____

53. Which of the following animals were present at the site of the attack? (Answer each item.)

	Not Present	Present	Don't know/Uncertain
Birds - large	1	2	9
Birds - small	1	2	9
Buffaloes	1	2	9
Cats	1	2	9
Chickens	1	2	9
Cows	1	2	9
Dogs	1	2	9
Goats	1	2	9
Horses	1	2	9
Pigs	1	2	9
Other (specify) _____	1	2	9

54. Did you see any animals drink water after the attack?

Yes 1
No 2
Uncertain ..... 3] (go to Question 57)
Not applicable ..... 4]

55. If "Yes", how many days after the attack was this?

Same day 0
One day after 1
Two days after 2
Three days after 3
Four days after 4
Five days after 5
Six days after 6
Seven days after 7
Eight or more days after .. 8
Uncertain 9

56. Can you say what animals you saw drinking the water and describe if anything happened after they drank the water?

INSTRUCTIONS

Using the following Codes record the type of animal observed, the symptoms observed and the onset or time when each of the symptoms was observed.

Animal Codes		Symptom Codes		Onset	
Bird - large	01	Died with no symptoms	01	Immediate	01
Bird - small	02	No sign/normal	02	Hours later	02
Buffalo	03	Choked	03	Next day	03
Cat	04	Wheezed	04	2 days later	04
Chicken	05	Vomited	05	3 or more days ..	05
Cow	06	Diarrhoea	06	Don't recall	09
Dog	07	Blood in stools	07		
Goat	08	Increased salivation	08		
Horse	09	Increased nasal secretion	09		
Pig	10	Convulsions	10		
Other _____ (specify)	11	Cough	11		
		Staggered walk	12		
		Other _____ (specify) ...	13		
		Uncertain	99		

Example: If a cat had diarrhoea immediately, then code: 04 06 01 under the appropriate headings.

Animal Species	Symptoms	Onset
_____	_____	_____
	_____	_____
	_____	_____
_____	_____	_____
	_____	_____
	_____	_____
_____	_____	_____
	_____	_____
	_____	_____

57. More generally, can you tell me which animals died and approximately how many days after the attack it was that they died?

INSTRUCTIONS

Write the number of the code as indicated in Question 56 for each animal that died. If no animals died, write '90'. If the respondent is uncertain or does not know, write '99'. (The sequence of death is important. Probe.)

Animals that died:

at time of attack: _____
later that day: _____
the day after the attack: _____
2 days after the attack: _____
3 days after the attack: _____
4 days after the attack: _____
5 days after the attack: _____
6 days after the attack: _____
7 days after the attack: _____
8 or more days after the attack: _____

58. Please describe how these animals died.

INSTRUCTIONS

Using the animal and symptom codes in Question 56, record the animals that died and the corresponding symptoms that were observed.

Animal Species	Symptoms
_____	_____
	_____
	_____
_____	_____
	_____
	_____
_____	_____
	_____
	_____

59. In animals that did not die, did you observe any signs or symptoms? Can you describe them and say how long the signs/symptoms lasted?

INSTRUCTIONS

> Using the animal and symptom codes in Question 56, record the animals that did not die and any symptoms that were observed. Then under the heading No. of Days, record the number of days the symptoms lasted; if uncertain, write '99'.

Animal Species	Symptoms	No. of Days
_____	_____	_____
	_____	_____
	_____	_____
_____	_____	_____
	_____	_____
	_____	_____
_____	_____	_____
	_____	_____
	_____	_____

60. Did you see anything on the leaves or plants after the attack?

Yes 1
No 2
Uncertain ..... 9] (go to Question 64)

61. If yes, what colour was it? (Use colour chart)

Colour: _____
Colourless 90
Uncertain 99

62. How would you describe the substance on the plants/leaves? (Answer each one.)

	Yes	No
Powder or dust-like	1	2
Droplets	1	2
Sticky	1	2
Burnt holes	1	2
Other (specify) _____	1	2

63. Did you see any changes in the plants/leaves after the attack?

Yes 1
No 2
Uncertain ..... 9 (go to Question 67)

64. In what types of plants/leaves did you see a change?

Specify names of plants/trees. (Record both indigenous name and common name if known. Use photographs to identify plants.)

_____
_____

65. What changes did you see in these plants/leaves?

Discolouration (specify) _____ 1
Withered 2
Spots (specify colour: _____) 3
Other (specify) _____ 4

66. How long after the attack was it before you saw a change in these plants/leaves?

Immediately 01
Later same day 02
1 day after 03
2 days after 04
3 days after 05
4 days after 06
5 days after 07
6 days after 08
7 days after 09
8-14 days after 10
15 or more days after 11
Uncertain/don't recall 99

67. After the attack, did you see any animals eat any vegetables/ Plants/leaves from the fields or the forest?

Yes 1
No 2
Uncertain ..... 9 (go to Question 72)

68. Can you say which animals you saw eating plants/leaves and how many days after the attack it was that you saw them eating?

INSTRUCTIONS

Write the number of the code for the animals as given in Question 69 and record the number of days after the attack the animal was observed eating. If uncertain how many days after the attack, write '99'.

Animal Species	No. of Days
_____	__ __
_____	__ __
_____	__ __

69. Can you describe what happened to the animals after these plants/ leaves were eaten?

INSTRUCTIONS

Using the following Codes record the type of animal observed, the symptoms observed and the onset or time when each of the symptoms was observed.

Animal Codes		Symptom Codes		Onset	
Bird - large	01	Died with no symptoms	01	Immediate	01
Bird - small	02	No sign/normal	02	Hours later	02
Buffalo	03	Choked	03	Next day	03
Cat	04	Wheezed	04	2 days later	04
Chicken	05	Vomited	05	3 or more days ..	05
Cow	06	Diarrhoea	06	Don't recall	09
Dog	07	Blood in stools	07		
Goat	08	Increased salivation	08		
Horse	09	Increased nasal secretion	09		
Pig	10	Convulsions	10		
Other _____ (specify)	11	Cough	11		
		Staggered walk	12		
		Other _____ (specify) ...	13		
		Uncertain	99		

Animal Species	Symptoms	Onset
_____	_____	_____
	_____	_____
	_____	_____
_____	_____	_____
	_____	_____
	_____	_____
_____	_____	_____
	_____	_____
	_____	_____

70. Did any of these animals die?

Yes 1
No ..... 2 (go to Question 72)

71. Which animals died? (Write the number of the code for the animals as indicated in Question 69. If uncertain or do not recall which animals died, write '99'.)

_____

72. Did you or anyone eat the animals that died or that had any of the signs/symptoms you described?

Yes, respondent ate meat 1
Yes, others ate meat but not respondent 2
Yes, others including the respondent ate meat 3
No ..... 4 (go to Question 76)

73. Can you describe what happened after you/they ate the meat of these animals?

Some became ill 1
All became ill 2
Nothing happened 3
Uncertain ..... 4] (go to Question 76)

74. Can you describe the signs/symptoms of the people that became ill?

INSTRUCTIONS

Write the Item Number given in Question 39 which corresponds to the symptoms/signs noted by respondent.

Symptoms: _____
_____
_____

75. How long after eating these animals was it before you or other people became ill?

Immediately	1
2-3 hours afterwards	2
Longer than 3 hours but same day	3
1 day later	4
2 days later	5
3-4 days later	6
Uncertain	9

76. After the attack, did you or anyone you know eat any plants or vegetables grown in the area?

Yes, respondent ate	1	
Yes, others ate but not respondent	2	
Yes, others including the respondent ate	3	
No	4	(go to Question 85)
Uncertain	5	

77. If yes, specify the foods that were eaten.

Vegetables/Plants/Leaves

_____

_____

78. Specify which of these foods were collected from the fields, forests or were stored uncovered.

Unprotected foods: _____

_____

79. What foods did you eat uncooked?

Uncooked foods: _____

_____

80. How many days after the attack was it before you ate this food?

Same day	0
1 day after	1
2 days after	2
3 days after	3
4 days after	4
5 or more days (give details) _____	5

81. Can you describe what happened after these foods were eaten?

Became ill	1	
Nothing happened	2	(go to Question 85)
Uncertain/don't recall	3	

82. Can you describe the signs/symptoms you had when you became ill?

Write the Item Number given in Question 39 which corresponds to the symptoms noted.

Symptoms _____

_____

83. How long after eating these foods was it before you became ill?

Immediately	1
2-3 hours afterwards	2
Longer than 3-4 hours but same day	3
1 day later	4
2 days later	5
3-4 days later	6
Uncertain	7

84. Which of the foods that you ate do you think caused your illness? (If uncertain or don't know, write '99'.)

Specify name of food(s): _____

_____

_____

85. Did any other person you know become ill in the same incident?

Yes	1	
No	2	(go to Question 87)
Uncertain	9	

86. Specify the name of the person(s), their sex, age, relationship to the respondent and where they are now located?

INSTRUCTIONS

> Probe the relationship to the respondent to determine if the individual is a "true" kinsman (e.g. brother) or a putative kinsman (e.g. "clan brother", "cousin brother"). If the individual died as a result of the attack, write "dead" under the heading Location.

Name	Sex	Age	Relationship	Location
_____	___	___	_____	_____
_____	___	___	_____	_____
_____	___	___	_____	_____
_____	___	___	_____	_____

87. Specify the name of the person(s) who died, as well as their age and sex; and, indicate how many days after the attack that death occurred.

Name	Age	Sex	Days
_____	___	___	_____
_____	___	___	_____
_____	___	___	_____
_____	___	___	_____

88. In total, how many people died as a result of the attack?

Number _____

89. Which of the following statements best describe the type of people who died?

Most old people died 1
Mostly young people died 2
Mostly, old people and young children died 3
Mostly, those people close to the explosion/spraying died 4
All sorts of people died 5

90. After the attack, did any strangers or the "enemy" come to the village/site of attack?

Yes 1
No 2
Uncertain ..... 9] (go to Question 93)

91. When did these people enter the village?

Uncertain/don't recall 99
Same day 00
Days (specify number of days after attack) _____

92. Were any of these people wearing any special clothing?

Yes ..... 1 (If yes, describe: _____)
No 2
Uncertain/Don't recall 9

93. Did you collect any samples, from the site of the attack?

Yes 1
No 2

94. Who did you give these sample to?

Name _____

Place _____

INSTRUCTIONS

End of interview, ask the respondent for any additional comments or information. Instruct the respondent not to discuss the interview with other members of his family or the the community.

Comments: _____

_____

_____

_____

_____

Part 5: Assessment of Respondent

INSTRUCTIONS

The following questions are to be completed by the interviewer after the interview.

1. How confident are you that the interpreter accurately translated the meaning of all questions?

Confident									Not Confident
1	2	3	4	5	6	7	8	9	10

2. How certain or uncertain would you say the respondent was in providing his testimony on:

	Certain								Uncertain
The description of the attack	1	2	3	4	5	6	7	8	9	10
The description of the agent	1	2	3	4	5	6	7	8	9	10
His medical history	1	2	3	4	5	6	7	8	9	10
The onset of his signs and symptoms	1	2	3	4	5	6	7	8	9	10
The description of his symptoms	1	2	3	4	5	6	7	8	9	10
The onset of animal signs and symptoms	1	2	3	4	5	6	7	8	9	10
The sequence of animal deaths	1	2	3	4	5	6	7	8	9	10
The description of animal symptoms	1	2	3	4	5	6	7	8	9	10
The onset of changes in the vegetation	1	2	3	4	5	6	7	8	9	10

3. Over all how reliable is the information given by this respondent? Would you say:

Reliable									Unreliable
1	2	3	4	5	6	7	8	9	10

Part 6: Expert Information

INSTRUCTIONS

> The following questions are to be completed by the interviewer after interviewing local experts who attended to the respondent's/patient's medical needs after the attack.

1. Is the patient's field medical card or medical record available?

   Yes 1
   No 2

2. Does the medical record indicate whether the patient received treatment related to this incident?

   Yes 1
   No 2

3. If "Yes", specify the symptoms which are recorded as well as the diagnosis. Indicate the treatment received and the date of admission. (Write in the Item Number of the symptoms noted as specified in Question 39 of Part 4.)

   Date of Admission: _____

   Diagnosis: _____

   Symptoms: _____

   _____

   Treatment: _____

4. Specify the results of any bacteriological, pathological or physiological tests carried out on behalf of the patient (e.g. blood tests, on 25/2/85 exhibiting Plasmodium falciparum). If no tests performed, write 'None'.)

Test	Date	Result
_____	_____	_____
_____	_____	_____
_____	_____	_____

5. Do any of the tests demonstrate the presence of toxic chemicals?

Exposure to toxic chemicals not tested .. 1 (go to Question 8)
Tests did not demonstrate presence of chemical/toxins 2
Tests demonstrated presence of chemical/toxins 3

6. If toxic chemicals were present, please specify the type and indicate (together with supporting evidence) how conclusive the results of the tests were.

_____

_____

7. Indicate possible sources of the toxic chemical and briefly comment on the natural occurrence of the chemical in the area.

_____

_____

INSTRUCTIONS

The following questions are to be completed by the interviewer after interviewing the individual(s) identified in Question 94 of Part 4 or after interviewing expert witnesses about any tests carried out in relation to this incident.

8. Specify the results of any tests carried out on the sample. If the results of the tests cannot be obtained, give reasons why they are not available.

Test	Date	Result

9. Do any of the tests demonstrate the presence of toxic chemicals?

No tests performed on sample 1
Tests did not demonstrate presence of toxic chemicals .. 2
Tests did demonstrate presence of toxic chemicals 3

10. If toxic chemicals were present, please specify the type and indicate (together with supporting evidence) how conclusive the results of the tests were.

_____

_____

11. Indicate possible sources of the toxic chemical and briefly comment on the natural occurrence of the chemical in the area.

_____

_____